PB-227 504

AIR POLLUTION MEASUREMENTS IN BALTIMORE, MARYLAND, MARCH AND APRIL 1964

Thomas E. Kreichelt, et al

Robert A. Taft Sanitary Engineering Center
Cincinnati, Ohio

November 1964

DISTRIBUTED BY:

NTIS

National Technical Information Service
U. S. DEPARTMENT OF COMMERCE
5285 Port Royal Road, Springfield Va. 22151

PB 227 504

AIR POLLUTION MEASUREMENTS IN BALTIMORE, MD.

March and April 1964

Thomas E. Kreichelt
Public Health Service
Division of Air Pollution
Technical Assistance Branch

and

Elkins W. Dahle, Jr., Director
Bureau of Industrial Hygiene
Baltimore City Health Department

Reproduced by
NATIONAL TECHNICAL
INFORMATION SERVICE
U S Department of Commerce
Springfield VA 22151

U. S. Department of Health, Education, and Welfare
Public Health Service
Division of Air Pollution
Robert A. Taft Sanitary Engineering Center
Cincinnati, Ohio 45226

November 1964

Technical Study Staff

Baltimore City Health Department

Elkins W. Dahle, Jr., Director, Bureau of Industrial Hygiene

C. Edwards Sachs, Senior Public Health Engineer

Sanford M. Belth, Principal Chemist

Maryland State Department of Health

John M. Brown, Public Health Engineer

George P. Ferreri, Public Health Engineer

Kenneth Hallam, Chemist

Public Health Service, Division of Air Pollution, Technical Assistance Branch

Seymour Hochheiser, Chief Chemist

Thomas E. Kreichelt, Assistant Sanitary Engineer

Melvin Nolan, Analytical Chemist

William Basbagill, Analytical Chemist

Fred Jentsch, Physical Science Aide

Acknowledgment

Delance O. Martin, Meteorologist, U.S. Weather Bureau Research Station, Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio for assistance in analysis of weather data and preparation of the meteorological sections of this report.

Table of Contents

	Page
CONCLUSIONS AND RECOMMENDATIONS	1
INTRODUCTION	2
CONDUCT OF STUDY	3
DISCUSSION OF RESULTS	7
Particulate Pollutants	7
Soiling Index	9
Total Suspended Particulates	10
Gaseous Pollutants	14
Sulfur Dioxide	14
Carbon Monoxide	14
Carbon Dioxide	16
Oxides of Nitrogen	17
Total Oxidants	17
Total Gaseous Hydrocarbons	19
Total Aliphatic Aldehydes	20
High Air Pollution Days	20
Meteorological Observations	23
REPRESENTATIVENESS OF METEOROLOGICAL CONDITIONS DURING THE STUDY	24
REFERENCES	27
APPENDICES - TABULATION OF AIR POLLUTION AND METEOROLOGICAL MEASUREMENTS	29
Appendix A - Data Collected by Manual Methods	29
Appendix B - Data Collected by Automatic Methods	37

Conclusions and Recommendations

Air pollution concentrations measured in this brief study are sufficiently great to justify further planning and development of an air resource management program in the Baltimore area. Conclusions based on the limited data of this study are as follows:

1. Pollution due to particulate matter is higher than desirable. Atmospheric particulate concentrations exceeded 200 micrograms per cubic meter 5 out of 36 days of the study or 14 percent of the time. Soiling index values were rated as "heavy" or greater during 22 percent of the study period. These measurements were made during the spring season when suspended particulate concentrations are usually somewhat lower than in the winter. Fuel burned for heating of homes, offices, and other buildings during cold weather adds to the pollution concentrations.
2. Pollution due to sulfur dioxide is sometimes a problem. The average sulfur dioxide concentration during the study was 0.06 ppm but did reach an hourly concentration of 0.24 ppm. Relatively little fuel was used for space heating as compared with what could be expected during the winter months. Even though atmospheric ventilation was below normal during the period, resulting in greater than normal values, sulfur dioxide concentrations would be expected to be greater during late autumn and winter periods when fuel usage is at a maximum.
3. Photochemical-type smog was neither detected nor expected during the spring season. The relatively large concentrations of oxides of nitrogen, hydrocarbons, and aldehydes present suggest, however, that photochemically produced smog may be a problem during the summer months. The potential for the occurrence of photochemical smog is greatest in Baltimore during the summer months concomitant with the occurrence of greatest intensity and longest duration of sunlight.

It is recommended that a continuing air monitoring program be instituted at strategic sampling sites throughout the area to augment the data collected in this pilot study, to determine the effectiveness of control programs, to determine seasonal and yearly trends in pollution, to document long-term trends of air quality as related to changes in the nature of pollutant sources, and to provide data upon which to base air resource management decision- Because air pollution does not recognize political boundaries, this air mor oring program and other aspects of the air resource management program should be extended throughout the entire metropolitan area.

Introduction

In cooperation with the City of Baltimore, the Division of Air Pollution, Public Health Service, conducted a 5-week pilot study of ambient air quality in March and April 1964. Various gaseous and particulate pollutants and meteorological parameters were measured on a continuous basis by using mainly the facilities and equipment contained in a mobile air sampling laboratory.

The City of Baltimore normally monitors certain gaseous pollutants, such as sulfur dioxide, total oxidants, and particulate pollutants. The city needs to monitor air quality to: (1) Determine the nature and extent of air pollution; (2) relate levels of air pollution to factors influencing concentration such as topography, population density, pollution sources, climate, meteorological conditions, and other influences; (3) associate levels of air pollution to its effects, such as detriment to the health of humans and animals, damage to vegetation and property, and other economic and aesthetic losses; (4) evaluate the effectiveness of control programs; (5) determine the degree of reduction of pollutant emissions needed for various classes of pollution sources; (6) determine trends in air pollution over the years; (7) assist in developing air quality standards; and (8) provide certain protection of the public from exposure to hazardous concentrations of air pollutants by means of an air pollution alert system.

The major purposes of the short-term study were to: (1) Obtain comprehensive measurements of gaseous and particulate air pollutants in the downtown area; (2) train air pollution investigators from both the City of Baltimore and State of Maryland and the surrounding counties in the application of methodology; (3) evaluate and compare air pollution measurement techniques; and (4) enhance public awareness of the air pollution problem and encourage support for local air pollution control and monitoring programs.

The usefulness of these short-term studies for accomplishing these objectives was demonstrated in a previous pilot study in Pittsburgh.[1] In the Baltimore study 5 weeks of air pollution measurements were obtained; about 20 sanitarians, chemists, and engineers were provided training; and the public was given the opportunity to observe the laboratory and question the investigators on air pollution.

Some of the data obtained in this study, such as the range of concentrations of air contaminants, relationship among levels of air pollutants, and the relationship of meteorological factors and air pollution levels are presented here. Also planned are scientific papers for the technical literature concerning the measurement methods used and the relationship among them.

Conduct of Study

The mobile laboratory shown in the background in Figure 1, was situated in the downtown commercial district between the Baltimore City Hall and the War Memorial Building from March 5 to April 17, 1964. Meteorological equipment and a high-volume atmospheric particulate sampler were located on the roof of the fire department headquarters, about one-half block from the laboratory (Figure 2). Meteorological data were also obtained from Friendship Airport, located south of Baltimore, and particulate samples were collected at the Ashburton Filtration Plant. Samples were collected continuously by using automatic sampling and analyzing equipment. Manual sampling techniques were also employed to collect 30-minute short-term samples periodically during the daytime. Sulfur dioxide, oxidants, nitrogen dioxide and nitric oxide, carbon monoxide, carbon dioxide, aldehydes, total suspended particulates, and soiling index were measured. Wind speed and direction, and temperature and humidity were measured.

The floor plan of the mobile laboratory is illustrated in Figure 3. Air samples were drawn through a common stainless steel intake manifold and then into various manual and automatic sampling instruments. When manual sampling equipment was used, chemical or physical analysis of the sample was performed later. Sampling, analysis, and recording were performed automatically and continuously by automatic monitoring instruments.

The mobile air sampling unit and supplementary units were manned by one chemist and one engineer either from the Technical Assistance Branch, Division of Air Pollution, Public Health Service, or from the Division of Air Pollution Control, Baltimore City Health Department. Other staff members of the Division of Air Pollution Control, Baltimore City Health Department, helped to prepare and maintain the measuring sites and equipment. The measurement program, including frequency of sample collection, methods used, and experimental work, is summarized in Table 1.

Figure 1. Attending opening ceremonies of mobile air-sampling laboratory in Baltimore, March 5, 1964, were (left to right) Mr. B. L. Werner, Director of Public Works of Baltimore; Mr. K. M. Hallam, Chemist, Division of Industrial Health and Air Pollution, Maryland State Department of Health; Mr. H. Pressman, Comptroller; Mr. E. W. Dahle, Director of Bureau of Industrial Hygiene; Mr. G. W. Schucker, Director of Sanitary Section; Mayor T. R. McKeldin; Dr. R. E. Farber, Commissioner of Health of Baltimore; and Mr. C. E. Sachs, Chief, Division of Air Pollution Control.

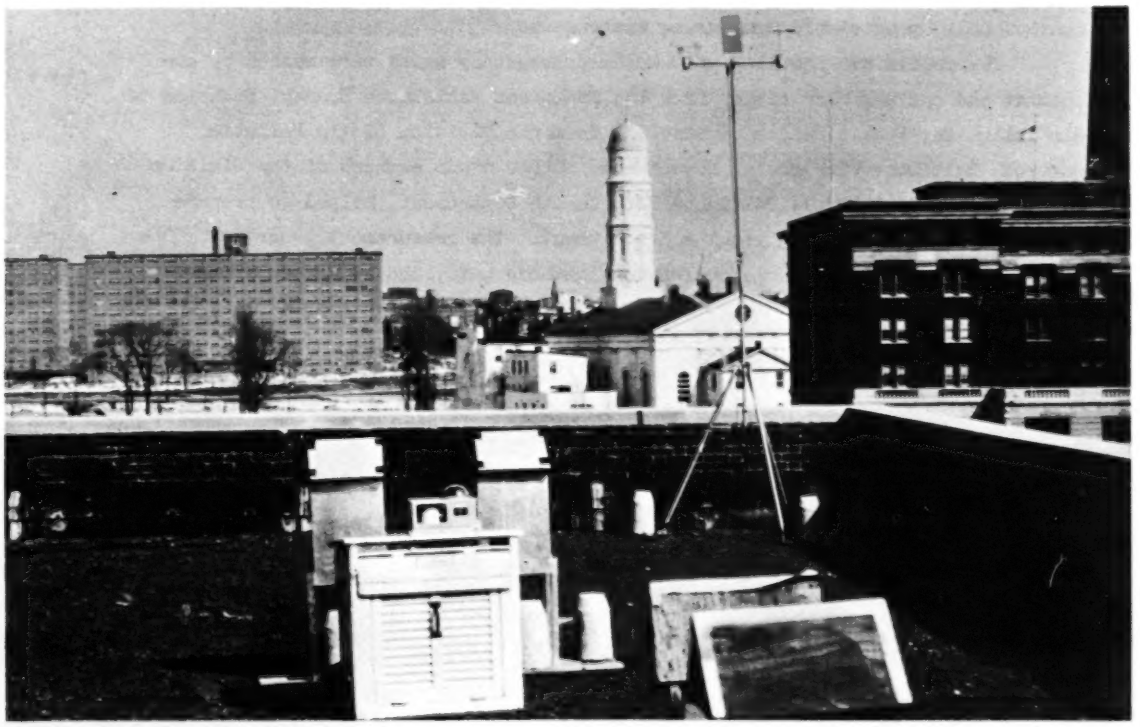

Figure 2. Meteorological measurement station on roof of Baltimore Fire Department headquarters.

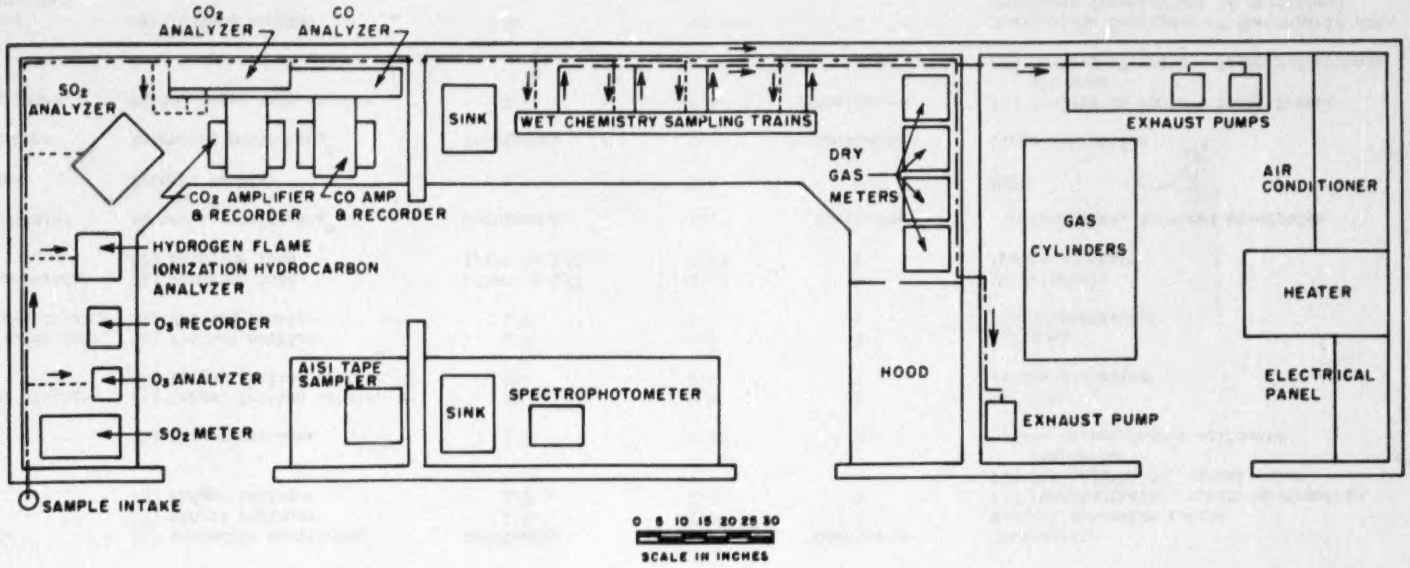

Figure 3. Floor plan of mobile air sampling unit.

Table 1. MEASUREMENT PROGRAM, BALTIMORE, MARYLAND, MARCH-APRIL, 1964

Pollutant or meteorological variable	Apparatus	Sampling interval, hr	Sampling rate, liters/min	Frequency of sample collection/day	Analytical method	Reference
Sulfur dioxide	(1) Automatic monitoring[a]	Continuous	3.0	Continuous	Electroconductivity	
	(2) Midget impinger with and without inline glass fiber or membrane prefilter	1/2	2.0	4	West-Gaeke	2
	(3) Large impinger, with and without inline glass fiber or membrane prefilter	1/2	20.0	4	Hydrogen peroxide	3
Oxidants	(1) Automatic monitoring[a]	Continuous	0.14	Continuous	Coulometric	
	(2) Midget impinger	1/2	1.0	4	Neutral potassium iodide	4
	(3) Midget impinger	1/2	1.0	4	(1) Phenolphthalin, spectrophotometric	5
					(2) Phenolphthalin, visual color comparator	6
	(4) Midget impinger	1/2	2.0	4	Sodium diphenylamine sulfonate	7
Nitrogen dioxide	(1) Large, fritted bubbler	24	0.4	1	Saltzman	8
	(2) Large, fritted bubbler	24	0.4	1	Jacobs-Hochheiser	9
Nitric oxide and nitrogen dioxide	(1) Fritted bubbler	1/2	0.4	4	Saltzman	8,10
	(2) Fritted bubbler	1/2	0.4	4	Jacobs-Hochheiser	9,10
Carbon monoxide	(1) Detector tube	1/120 to 1/2	0.10	4	Colorimetric	11
	(2) Detector tube	1/120 to 1/2	0.03	4	Length of stain	12
Carbon dioxide	Automatic monitoring[a]	Continuous	1.0	Continuous	Nondispersive, infrared absorption	
Aldehydes	Fritted bubbler	1	1.0	4	MBTH	13
Hydrocarbons	Automatic monitoring[a]	Continuous	0.5	Continuous	Flame ionization	
Soiling index	Filter paper tape sampler	2	6.0	Continuous	(1) Density of stain - light transmittance	14
					(2) Density of stain - light reflectance	15
Suspended particulates	High-volume sampler	24	50 cfm	1	Gravimetric (analyses of the organic and inorganic fraction may be performed)	16
Wind speed and direction	Wind system[a]	Continuous	n.a.[b]	Continuous	Electromechanical (cup anemometer) and potentiometric (wind vane)	
Temperature and relative humidity	Hygrothermograph[a]	Continuous	n.a.[b]	Continuous	Mechanical (differential expansion or contraction of metals due to heat - temperature; stretching or contraction of hair - relative humidity)	

[a]Commercially available continuous sampling, analyzing, and recording instruments.

[b]Not applicable.

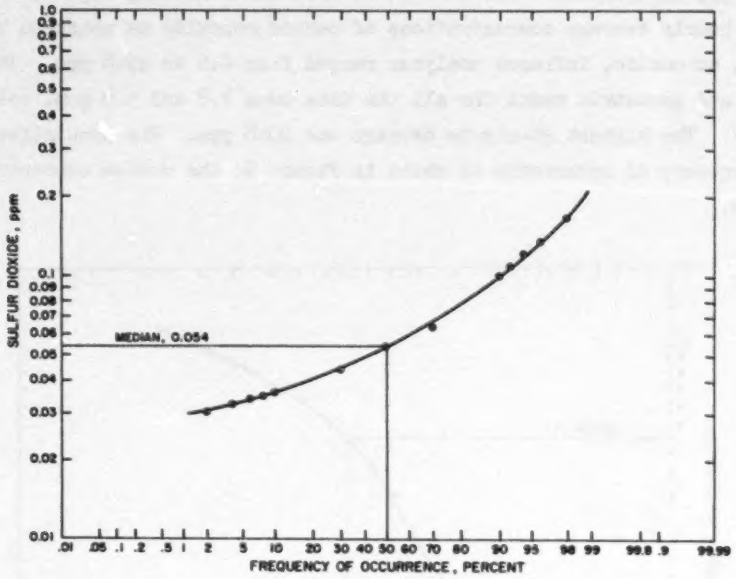

Figure 7. Frequency distribution of sulfur dioxide concentrations.

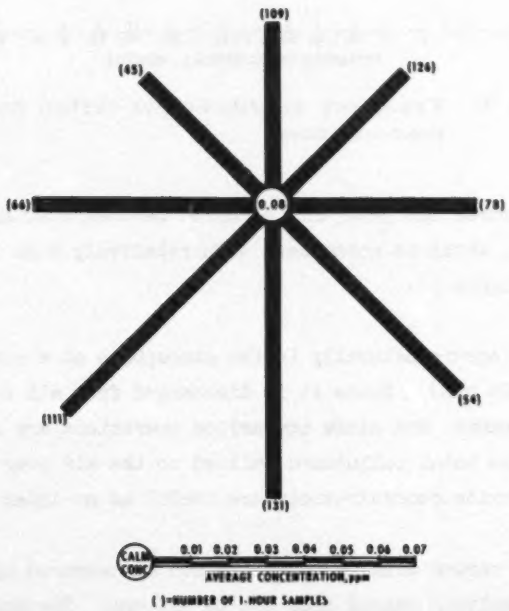

Figure 8. Variation of average sulfur dioxide concentration with wind direction.

In this study, measurements were made in an area of relatively high traffic density.

The hourly average concentrations of carbon monoxide as measured by continuous, automatic, infrared analyzer ranged from 0.6 to 19.8 ppm. The arithmetic and geometric means for all the data were 4.8 and 3.8 ppm, respectively (Table B-3). The highest 30-minute average was 20.8 ppm. The cumulative percentage frequency of occurrence is shown in Figure 9; the median concentration was 4.5 ppm.

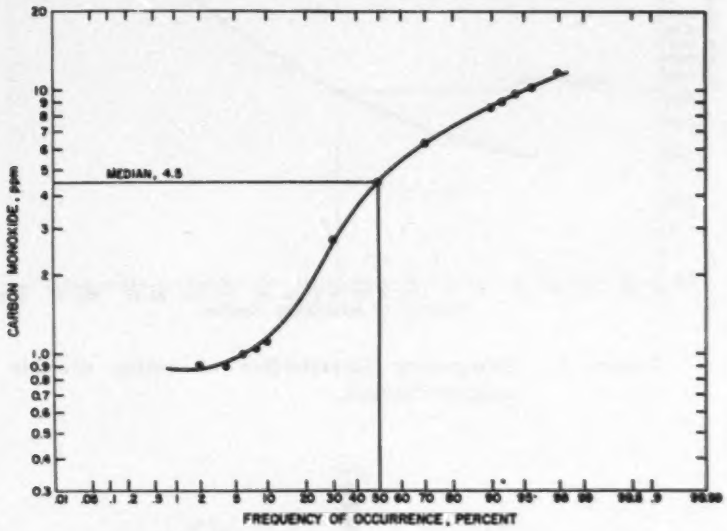

Figure 9. Frequency distribution of carbon monoxide concentrations.

Greatest concentrations generally occurred between 0800 and 0900, and between 1600 and 1800, which is coincident with relatively high traffic density during these hours (Figure 5).

Carbon Dioxide

Carbon dioxide occurs naturally in the atmosphere at a concentration of about 0.03 percent (300 ppm). Since it is discharged from all combustion processes in large amounts, and since combustion operations are often responsible for a large part of the total pollutants emitted to the air over the community, atmospheric carbon dioxide concentrations are useful as an index of air pollution levels in general.

Hourly average carbon dioxide concentration as measured by a continuous, automatic, infrared analyzer ranged from 271 to 517 ppm. The arithmetic and geometric means for all data were 357 and 355 ppm, respectively (Table B-4). The highest 30-minute average was 522 ppm. A comparison of the diurnal trend of

carbon dioxide concentrations with various pollutant concentrations shows that carbon dioxide, in general, follows the same diurnal pattern as carbon monoxide and hydrocarbons do but not the same as sulfur dioxide or smoke index (Figure 5). Since hydrocarbons and carbon monoxide are most representative of products of motor vehicle exhaust, the atmospheric carbon dioxide level in the downtown area would appear to be a useful index of atmospheric pollution due to automobile exhaust.

Daily average concentrations among various pollutants and carbon dioxide were compared with wind speed (Figure 10). Variation of the daily average concentration of all the pollutants measured and carbon dioxide follows the same pattern and is related inversely to wind speed. Since source strengths are not likely to vary greatly on a day-to-day basis (except for pollutants arising from space heating), as do the meteorological factors, the governing factors in the fluctuation in day-to-day atmospheric pollution concentrations are meteorological, that is, wind speed, wind direction, vertical temperature gradient, and so forth. Source strengths would vary, however, on a seasonal basis due to space heating and other activities.

Oxides of Nitrogen

Oxides of nitrogen originate mainly from the combustion of fuels. Hydrocarbons and oxides of nitrogen, in the presence of sunlight, enter into reactions that produce the Los Angeles-type photochemical smog, which causes eye irritation, plant damage, and reduced visibility. The greatest nitrogen dioxide and nitric oxide concentrations recorded during the study were 0.16 ppm and 0.46 ppm, respectively (Tables A-4,5). The arithmetic means for nitrogen dioxide and nitric oxide were 0.06 and 0.09 ppm, respectively. These data were obtained by using four 30-minute samples collected and analyzed manually by the Saltzman method. The data obtained by the continuous automatic monitoring instrument were incomplete and are not discussed here.

Greatest concentrations of nitric oxide usually occurred at 0830 (average = 0.11 ppm), which may be attributed to the relatively high traffic density at this hour. There was no significant diurnal variation in nitrogen dioxide concentrations.

The concentrations of nitrogen oxides measured are adequate to indicate a potential for the occurrence of photochemical smog under suitable meteorological conditions such as would be present during the summer months.

Total Oxidants

Total oxidant measurements provide an estimate of oxidizing substances such as ozone, peroxides, and peroxyacylnitrate (PAN) present in the atmosphere.

Ozone occurs naturally in the atmosphere in the range 0.01 to 0.05 ppm as a result of ultraviolet photolysis of oxygen. Ozone, PAN, and other peroxides

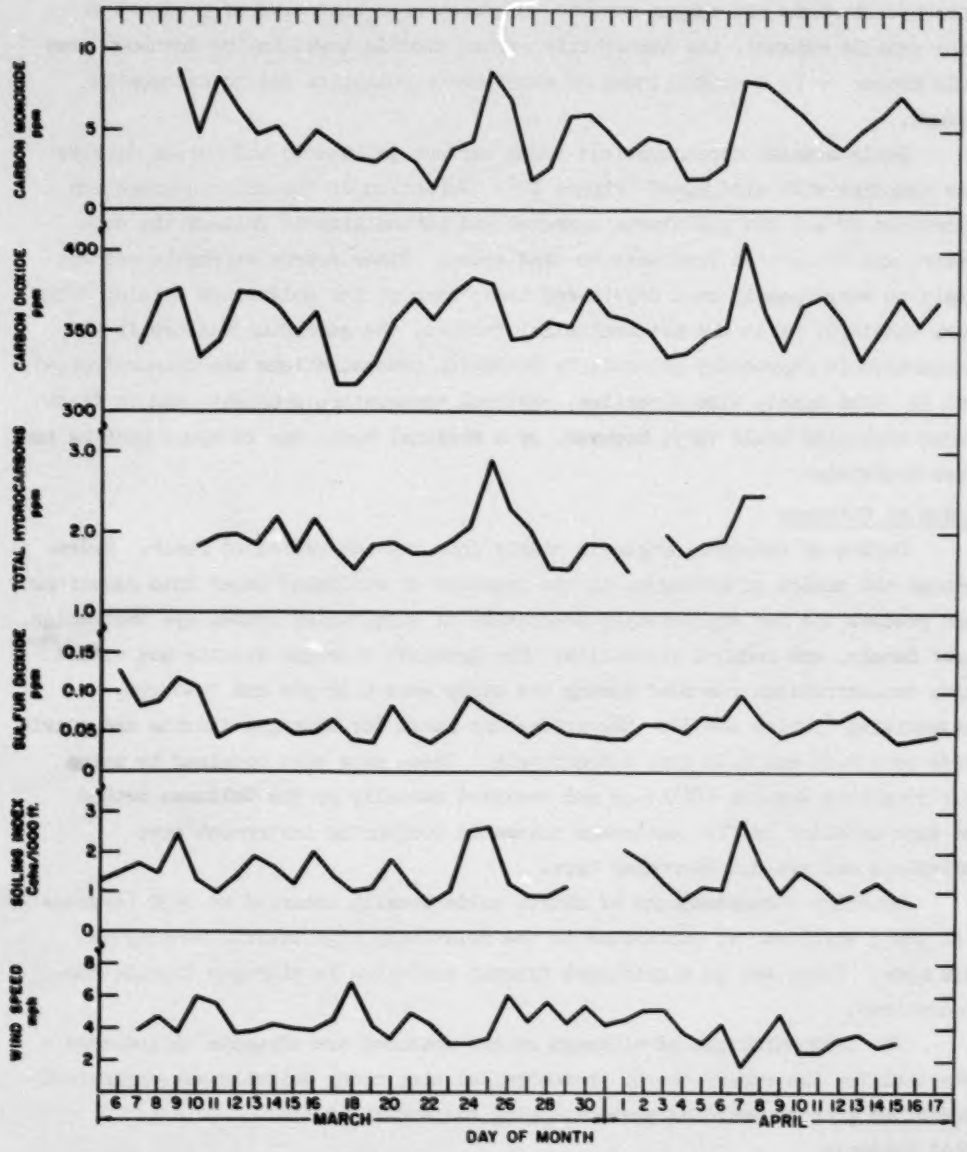

Figure 10. Daily variation of pollutant concentrations with wind speed.

are formed under the influence of solar energy by reactions involving hydrocarbons and nitrogen oxides.[23]

Oxidants are associated with photochemical smog, which causes plant damage, eye irritation, visibility reduction, and respiratory irritation if the concentration becomes excessive. The California ambient air quality standard for oxidants is 0.15 ppm for 1 hour as measured by the potassium iodide method, which is the level at and above which manifestations of photochemical smog occur.

During this study, oxidants were measured continuously with an automatic coulometric analyzer. Hourly average concentrations were consistently below the minimum detectable amount (about 0.02 ppm), both by the automatic methods and the manual methods. Oxidant concentrations would be greater in Baltimore during the summer months owing to the influence of sunlight.

Total Gaseous Hydrocarbons

Total gaseous hydrocarbons were measured continuously with an automatic flame ionization instrument. The results are expressed in parts per million as total carbon atoms, or methane. Hourly average hydrocarbon content ranged from 0.8 to 4.8 ppm. The arithmetic and geometric mean of all data collected were 2.0 and 1.9, respectively (Table B-5, Appendix B). The greatest 30-minute average concentration was 5.1 ppm. The cumulative frequency of occurrence is plotted in Figure 11. The median value for the study period was 1.90 ppm.

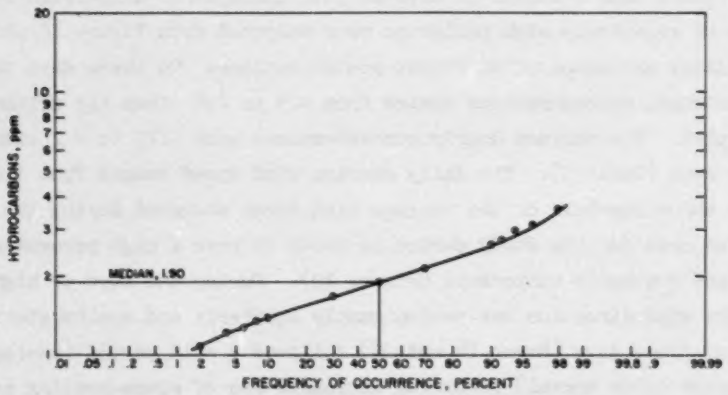

Figure 11. Frequency distribution of total hydrocarbon concentrations.

Greatest concentrations generally occurred from 0730 to 1830, corresponding to hours of highest automobile traffic density (Figure 5).

Hydrocarbons are emitted into the atmosphere from poor combustion operations, particularly gasoline combustion; from handling, storage, and use of volatile hydrocarbons and materials containing them; and from certain industrial and

commercial operations. Hydrocarbons, particularly C_4 to C_7 unsaturates, interact with nitrogen oxides in the presence of sunlight tc form photochemical smog in the atmosphere. Since these samples were collected in an area of relatively high traffic density, the concentration of hydrocarbons measured during this study may be attributed largely to automotive emissions.

Ethylene, which is included in the total hydrocarbon measurement, is a highly potent phytotoxicant. The commercial variety of orchids, for example, is damaged upon exposure to 0.05 ppm for 6 hours.[24]

Total Aliphatic Aldehydes

The total aliphatic aldehyde measurement includes formaldehyde, acetaldehyde, acrolein, propionaldehyde, and others. In test chamber studies with human observer panels, formaldehyde and acrolein appeared to be the principal eye irritants in irradiated automobile exhaust.[23] Thirty-minute air samples collected four times daily for aldehyde measurement varied from 0.01 to 0.20 ppm, with an arithmetic and geometric mean of 0.04 and 0.03, respectively (Table A-6). Greatest concentrations generally occurred during the morning hours.

HIGH AIR POLLUTION DAYS

Although there were no high air pollution potential advisories announced by the Weather Bureau Research Station at the Robert A. Taft Sanitary Engineering Center in Cincinnati, Ohio, during the study period for the area that included Baltimore, there were a number of days of poor atmospheric-dispersion conditions. These days of relatively high pollution were selected from Figure 10, which represents the daily variation of pollutant concentrations. On these days the daily average pollutant concentrations varied from 0.5 to 2.4 times the arithmetic mean of all samples. The maximum hourly concentrations were 0.75 to 4.1 times the arithmetic mean (Table 5). The daily average wind speed ranged from 1.6 mph to 3.7 mph or about one-half of the average wind speed observed during the study. The average wind rose for the study period is shown to have a high percentage of northerly and southerly components (Figure 12). During the days of high pollution, however, the wind direction was predominantly southerly and southwesterly (Figure 13). Two of these days (March 24 and 25) followed a cold period (averaging more than 5 degrees below normal) requiring increased use of space-heating equipment. This cold period also included one of the heaviest snowfalls of the closing winter season.

Source strengths for given pollutants vary with season. The potential for sulfur dioxide and particulate pollution would be expected to be higher in the winter months because emissions resulting from the combustion of coal and fuel oil for space heating would be at a maximum. Open burning also adds large amounts of both gaseous and particulate pollutants into the atmosphere and would tend to be seasonal when leaf burning occurs. On the other hand, the potential

Table 5. ATMOSPHERIC MEASUREMENTS ON DAYS OF RELATIVELY HIGH AIR POLLUTION

Date, 1964	Avg wind speed, mph	Pollutant and unit of measure	Max hourly conc	Time of occurrence[a]	Daily avg	Arith mean[b]	Max hourly conc/ arith mean	Daily avg/ arith mean
March 9	3.7	Soiling index, Cohs/1000 ft[c]	5.8	1000	2.5	1.4	4.1	1.8
		Total suspended particulates, $\mu g/m^3$[d]			241	150		1.6
		SO_2, ppm[e]	0.24	1100	0.12	0.06	4.0	2.0
		NO + NO_2, ppm[f]	No data					
		CO_2, ppm[e]	427	1000	377	357	1.2	1.1
		CO, ppm[e]	13.1	1700	8.8	4.8	2.8	1.8
		Aliphatic aldehydes, ppm[f]	No data					
		Total hydrocarbons, ppm[e]	No data					
March 24	3.0	Soiling index, Cohs/1000 ft[c]	4.8	0600	2.5	1.4	3.4	1.8
		Total suspended particulates, $\mu g/m^3$[d]			310	150		2.1
		SO_2, ppm[e]	0.20	0700	0.09	0.06	3.3	1.5
		NO + NO_2, ppm[f]	0.27	0830	0.16	0.15	1.8	1.1
		CO_2, ppm[e]	477	0500	383	357	1.3	1.1
		CO, ppm[e]	7.9	1700	4.4	4.8	1.6	0.9
		Aliphatic aldehydes, ppm[f]	0.03	0830	0.02	0.04	0.75	0.5
		Total hydrocarbons, ppm[e]	2.4	1700	2.1	2.0	1.2	1.1
March 25	3.3	Soiling index, Cohs/1000 ft[c]	4.6	0400	2.6	1.4	3.3	1.9
		Total suspended particulates, $\mu g/m^3$[d]			356	150		2.4
		SO_2, ppm[e]	0.12	0500	0.07	0.06	2.0	1.2
		NO + NO_2, ppm[f]	0.42	0830	0.23	0.15	2.8	1.5
		CO_2, ppm[e]	471	0600	380	357	1.3	1.1
		CO, ppm[e]	14.4	0700	8.7	4.8	3.0	1.8
		Aliphatic aldehydes, ppm[f]	0.06	1530	0.05	0.04	1.5	1.3
		Total hydrocarbons, ppm[e]	4.2	0700	2.9	2.0	2.1	1.5
April 7	1.6	Soiling index, Cohs/1000 ft[c]	4.8	1800	2.8	1.4	3.4	2.0
		Total suspended particulates, $\mu g/m^3$[d]			187	150		1.2
		SO_2, ppm[e]	0.17	0900	0.08	0.06	2.8	1.3
		NO + NO_2, ppm[f]	0.35	1530	0.26	0.15	2.3	1.7
		CO_2, ppm[e]	517	1800	406	357	1.4	1.1
		CO, ppm[e]	18.4	1900	8.3	4.8	3.8	1.7
		Aliphatic aldehydes, ppm[f]	0.05	1530	0.03	0.04	1.2	0.8
		Total hydrocarbons, ppm[e]	4.8	1900	3.0	2.0	2.4	1.5

[a] Starting at the hour indicated.

[b] Of all samples during study period.

[c] 2-hour samples.

[d] 24-hour samples ending between 1500-1600 on date indicated.

[e] Continuous automatic monitoring method.

[f] 30-minute samples collected by manual methods.

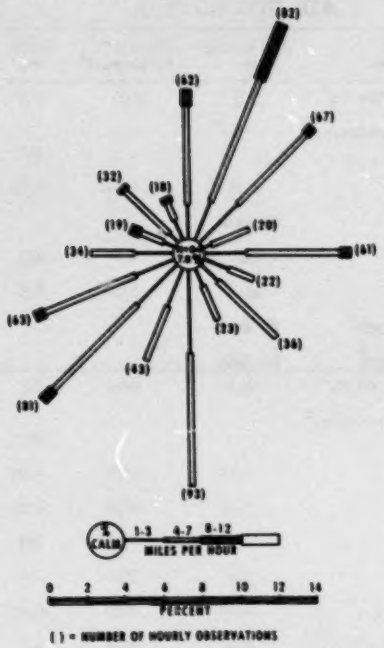

Figure 12. Wind rose for Baltimore, Md., March 7 to April 16, 1964. (Data from mobile laboratory meterological equipment).

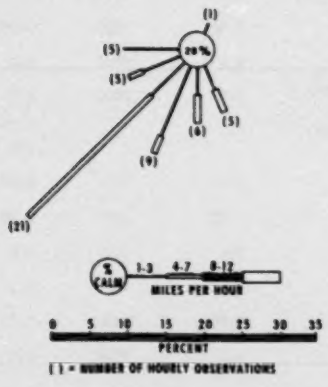

Figure 13. Wind rose for Baltimore, Md., showing high air pollution days. (Data from mobile laboratory meteorological equipment).

for photochemical smog would be greatest during the summer months because of the duration and intensity of sunlight. Although during this study oxidants concentrations were extremely small, the relatively large concentrations of nitrogen oxides measured indicate that photochemical smog may be a problem in the summer months.

Based on the data obtained in this study, particularly on days of relatively high air pollution, and from a knowledge of the seasonal variation in pollution potential due to variation in source strengths and meteorology, pollution due to particulate matter, sulfur dioxide, and nitrogen oxides is considered to be a significant problem.

METEOROLOGICAL OBSERVATIONS

A wind speed and direction recorder and a hygrothermograph (for temperature and humidity records) were set up near the mobile laboratory. The meteorological data used in this report to relate air pollution measurements and meteorological parameters were those obtained at this special weather station. Measurements of wind speed and direction are given in Tables B-8 and B-9. Temperature and humidity data are given in Tables B-6 and B-7.

Representativeness of Meteorological Conditions During the Study

Climatological data and meteorological observations from the U.S. Weather Bureau Station at Friendship International Airport and at the Custom House in Baltimore were used to estimate the representativeness of the sampling period with respect to meteorological conditions affecting the production of some air pollutants (especially in the space-heating load), and with temperature-height sounding data from the U.S. Weather Bureau radiosonde station at Washington, D.C., with respect to meteorological conditions affecting the accumulation of air pollution in general.

Temperature and heating degree-days indicate the production of air pollution by the use of fuels for space heating. The sampling period was colder than normal for the time of year, averaging about 0.6 degree below normal at the Custom House and 1.4 degrees below normal at Friendship International Airport, with an excess of 30 heating degree-days at the Custom House and 56 at the Airport. This indicates a heating requirement in excess of normal of about 5 percent at the Custom House and 8.5 percent at the Airport. No extremely cold temperatures were recorded. The lowest temperatures during the sampling period were recorded on March 31 with 20 degrees at the Airport and 24 degrees at the Custom House.

Precipitation is of interest because it washes out pollution. It also reduces wind-blown dust because the ground becomes wet. Heavy snowfall may reduce automobile traffic generally and thereby be associated with smaller concentrations of pollutants from that source over a whole city. Total precipitation was only slightly below normal with 4.65 inches at the Custom House and 4.78 inches at the Airport, compared with normals of 5.02 inches and 4.86 inches respectively. Measurable precipitation occurred on 17 days during the sampling period, compared with a normal expectance of 15. Total snowfall at the airport was 13.6 inches, which compares with a normal for the months of March and April together of 5.8 inches and is an amount that can be expected in less than 1 out of 4 years for these months. Nearly all the snow fell within 24 hours, on March 21 and 22, and measurable amounts were recorded on the ground on only 2 days.

Wind speed is one of the two most important meteorological factors in determining air pollution concentrations. The lower the wind speed, the greater the concentration, with the effect most pronounced at very low wind speeds (7 mph or less). The average wind speed during this period was 9.9 mph, with 7 days having an average speed of 7 mph or less. This compares with an average speed of about 12.5 mph over a 5-year period. During the entire months of March and April hourly wind speeds of 7 mph or less were recorded 29 percent of the time, compared with a 10-year average of 19 percent of the time. There were 27 observations (or 4 percent of the time) of calm wind in March and 38

observations (or 5 percent of the time) in April, compared with 5-year averages of less than 2 percent for each month.

Vertical temperature gradient is the other most important meteorological factor influencing pollution levels. When the air nearer the ground is warmer than the air at higher levels, the warm air will tend to rise, causing vertical mixing of pollutants and smaller concentrations at ground level. When the air nearer the ground is colder than the air at higher levels there is a temperature inversion, and vertical mixing is inhibited with resulting greater concentrations of pollutants at ground level. Vertical temperature gradients are influenced by wind speeds producing turbulent mixing, by incoming solar and outgoing terrestrial radiation, by subsidence of air masses, cloud cover, and other factors. During the sampling period there were 19 of 31 mornings (0700 EST) with atmospheric inversions, or 61 percent of the days for which data are available. There were inversions also on 5 of 37 evenings (1900 EST), or 14 percent of the days for which data are available. Hosler[25] gives an average percentage frequency of inversions of 51 and 15 percent respectively for 0700 and 1900 EST during the spring season.

The potential for air pollution in a given area increases when an air mass stagnates. During periods of stagnation, vertical temperature gradients and low wind speeds may be expected to be unfavorable for the dispersion of pollutants. These conditions are forecast by the Weather Bureau Research Station at the U.S. Public Health Service's Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio, and the forecast messages are transmitted by teletype to local U.S. Weather Bureau Offices. The forecasts, which are referred to as "high air pollution potential advisories," indicate that poor dispersion conditions are expected to last 36 hours or more. There were none for the study period. Referring to Korshover's study[26] from 1936 to 1956 of atmospheric stagnation periods lasting 4 days or more, none were expected.

Wind direction is an important factor in determining air pollution concentrations at any specific location. The prevailing direction at the Airport for the study period was WNW, as is the 10-year prevailing direction for March and April. The most frequent directions recorded at the mobile laboratory during the study were, however, NNE, S, and SW, and on the days when relatively large pollution concentrations were measured, the wind was mostly SSW and SW but with low velocities (less than 5 mph).

It is concluded that, during the survey period, there would have been only a slight excess over the usual air pollution from space heating because of the slightly below normal temperatures. Wind speeds, however, were below normal with about 1½ times the usual frequency of winds of 7 mph or less, indicating poorer than usual dispersion conditions. This is borne out also by the high frequency of calm observations with over 2 times the average frequency in March

and nearly 3 times the average frequency in April. Inversion frequency both morning and evening was above normal, again indicating poor dispersion conditions.

It is, therefore, estimated that somewhat greater than average pollution concentrations were observed. Since no high air pollution potential advisory was issued, however, there is no indication that concentrations approached the maximum possible. Much greater pollution concentrations would be expected during stagnation periods in the months of August through October when very light winds and stable conditions can persist for more than a week at a time. Over a 21-year period there were more than 20 stagnation periods lasting 4 or more days during these fall months.[26]

References

1. Hochheiser, S., Burchett, M., and Dunsmore, H.J. Air Pollution Measurements in Pittsburgh. Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. November 1963.

2. West, P.W. and Gaeke, G.S. Fixation of Sulfur Dioxide as Disulfitomercurate, Subsequent Colorimetric Estimation. Anal. Chem., 28:1916. 1956.

3. Jacobs, M.D. and Greenburg, L. Sulfur Dioxide in New York City. Ind. Eng. Chem., 48:1517. 1956.

4. Recommended Methods in Air Pollution Measurements, California State Department of Public Health, Berkeley, California. 1960.

5. Bender, D.F. and Breidenbach, A.W. Modification of the Phenolphthalin Method for the Determination of Total Oxidants. Anal. Chem., 35:417. 1963.

6. Colorimetric Chemical Analytical Methods. The Determination of Atmospheric Oxidants. The Tintometer Limited. Salisbury, England.

7. Bovee, H.H. and Robinson, R.J. Sodium Diphenylamine Sulfonate as an Analytical Reagent for Ozone. Anal. Chem., 33:1115. 1961.

8. Saltzman, B.E. Colorimetric Microdetermination of Nitrogen Dioxide in the Atmosphere. Anal. Chem., 26:1949. 1954.

9. Jacobs, M.D. and Hochheiser, S. Continuous Sampling and Ultramicrodetermination of Nitrogen Dioxide in Air. Anal. Chem., 30:426. 1958.

10. Thomas, M.D., et al. Automatic Apparatus for Determination of Nitric Oxide and Nitrogen Dioxide in the Atmosphere. Anal. Chem., 28:1810. 1956.

11. Jacobs, M.D. The Chemical Analysis of Air Pollutants. Interscience, New York. 1960.

12. Kusnetz, H.L., et al. Calibration and Evaluation of Gas-Detecting Tubes. J. Amer. Ind. Hyg. Assoc., 21:361. 1960.

13. Hauser, T.R. and Cummins, R.L. Increasing the Sensitivity of the 3-Methyl-2 Benzothiazolone Hydrazone Test. Presented at the 145th Nat. Amer. Chem. Soc. Meeting, New York. Sept. 1963.

14. Hemeon, W.C.L., et al. Determination of Haze and Smoke Concentrations by Filter Paper Samplers. Air Repair, Aug. 1953.

15. ASTM Standards on Methods of Atmospheric Sampling and Analysis. D-22 Committee. American Society for Testing Materials, 1916 Race Street, Philadelphia, Pennsylvania. Dec. 1959.

16. Air Pollution Measurements of the National Air-Sampling Network. U.S. Department of Health, Education, and Welfare, Public Health Service Publication No. 978. Analyses of Suspended Particulates 1957-1961. Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. 1962.

17. California Department of Public Health. Technical Report of California Standards for Ambient Air and Motor Vehicle Exhaust. Berkeley, California. 1960.

18. Stern, A.C., ed. Air Pollution. Vol. II, Chap. 37, Stern, A.C. Air Pollution Standards. Academic Press, New York, 1962.

19. Oregon State Sanitary Authority. Pollution of Air, Chap. 449, Replacement Part. March 1, 1961, Portland, Oregon.

20. State of Colorado, House Bill No. 1505, Enacted March 18, 1964.

21. Munroe, W.A. State-wide Air Pollution Survey, Smoke Index. Public Health News, 29:227, 1958. Trenton, N.J.

22. Motor Vehicles, Air Pollution and Health, A Report of the Surgeon General to the U.S. Congress. 87th Congress, 2nd Session. House Document No. 489. U.S. Government Printing Office, Washington, D.C. 1962.

23. Leighton, P.A. Photochemistry of Air Pollution. Academic Press, New York. 1961.

24. California Department of Public Health. California Standards for Ambient Air Quality and Motor Vehicle Exhaust. Supplement No. 2. Berkeley, California, 1963.

25. Hosler, C.R. Low-Level Inversion Frequency in the Contiguous United States, Monthly Weather Review, 89:319, 1961.

26. Korshover, J. Synoptic Climatology of Stagnating Anti-cyclones East of the Rocky Mountains in the United States for the Period 1936-1956. Technical Report A60-7. Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. 1960.

Appendices–Tabulation of Air Pollution and Meteorological Measurements

Appendix A
Data Collected by
Manual Methods

Table A-1. TOTAL SUSPENDED PARTICULATES

Date, 1964	Concentration, $\mu g/m^3$
March 9	241
10	190
12	130
13	125
14	162
16	192
17	150
18	106
19	68
20	100
21	320
23	137
24	310
25	356
26	178
27	72
28	138
29	84
30	83
31	114
April 1	96
2	154
3	164
4	63
5	129
6	99
7	139
8	147
9	63
10	120
11	145
13	161
14	190
15	201
16	64
17	197
Arithmetic mean	150
Geometric mean	136
Maximum	356
Minimum	63

Table A-2. SULFUR DIOXIDE,[a] ppm

Date, 1964	Time[b] 0830	1030	1330	1530
March 9		0.28		0.06
10	0.16	0.05	0.01	
11	0.03	0.03	0.02	0.02
12	0.08	0.07		
13	0.04	0.03	0.12	0.07
14		0.05	0.04	0.05
16	0.04	0.03		0.02
17	0.07	0.02	0.07	0.02
18	0.03	0.03	0.03	0.04
19	0.03	0.03		0.02
20	0.05	0.04	0.18	0.20
21	0.10	0.07	0.07	0.08
23	0.06	0.03	0.02	0.02
24	0.05	0.10	0.05	0.11
25	0.10	0.11	0.05	0.05
26	0.08	0.10		0.01
27	0.03			
28	0.07	0.04	0.05	0.08
30	0.09	0.05		0.03
31	0.04	0.03		0.03
April 1	0.07	0.04	0.02	0.02
2	0.06	0.07		
3	0.10	0.08	0.09	0.04
4	0.05	0.03	0.02	0.02
6	0.11	0.03	0.13	
7	0.30	0.21	0.25	0.25
8	0.13	0.03		0.03
9	0.00	0.00		0.00
10	0.06	0.00	0.01	0.01
11	0.05	0.04	0.08	0.12
13	0.10	0.15	0.12	0.11
14	0.06	0.05	0.12	0.11
15	0.03	0.04	0.02	0.01
16		0.01		
17	0.10	0.01	0.01	
Maximum	0.30	0.28	0.25	0.25
Arithmetic mean	0.07	0.07	0.06	0.06

Arithmetic mean, all samples - 0.07
Geometric mean, all samples - 0.05

[a]Sampled by West-Gaeke method, nonfiltered.

[b]Thirty-minute samples beginning at time indicated.

Table A-3. CARBON MONOXIDE,[a] ppm

Date, 1964	Time[b]			
	0830	1030	1330	1530
March 10		3.2	3.6	
11	2.6	4.2	3.2	
12	4.2	3.2		
13	7.8			3.6
14		3.6	6.0	2.2
16	4.9	2.6		
17	6.0	4.9		3.6
18	4.9		2.9	4.2
19		2.6		1.9
20	4.2	1.9	2.1	
21	1.6		0.0	4.9
23	3.2		1.9	3.2
24		2.1	1.2	1.9
25	6.0	2.9	4.9	
26	4.9	6.0	3.6	
27	2.2			
28		1.3	0.0	0.0
30	3.6	6.0		
31	2.6	2.6		2.4
April 1	1.8		2.7	4.9
2		3.6		
3	3.6	6.0		
4	1.2	2.1		1.8
6			1.7	
7		2.6	7.8	4.2
8	6.0			
9				
10	6.0		4.9	4.9
11		1.1	1.9	3.2
13	6.0	3.6	4.9	
14	3.6	7.8		
15	3.6		2.2	3.2
16		1.5		
17	6.0			
Maximum	7.8	7.8	7.8	4.9
Arithmetic mean	4.2	3.6	3.1	3.0

Arithmetic mean, all samples - 3.7
Geometric mean, all samples - 3.3

[a] Sampled by MSA tubes.

[b] Thirty-minute samples beginning at time indicated.

Table A-4. NITROGEN DIOXIDE,[a] ppm

Date, 1964	Time[b] 0830	1030	1330	1530
March 9		0.09		0.05
10	0.06	0.04	0.01	
11	0.03	0.03	0.06	0.06
12	0.03	0.06		
13	0.05	0.05	0.07	0.01
14		0.11	0.01	0.07
16	0.06	0.05		0.09
17	0.05	0.06	0.10	0.05
18	0.03	0.03	0.03	0.04
19	0.08	0.04		0.05
20	0.05	0.04	0.09	0.07
21	0.04	0.06	0.06	0.07
23	0.05	0.03	0.04	0.02
24	0.09	0.07	0.03	0.09
25	0.16	0.09	0.11	0.10
26	0.03	0.07		0.04
27	0.04			
28	0.05	0.04	0.01	0.05
30	0.06	0.04		0.05
31	0.04	0.07		0.06
April 1	0.04	0.04	0.04	0.04
2	0.11	0.05		
3	0.09	0.06	0.08	0.09
4	0.03	0.02	0.03	0.03
6	0.05	0.04	0.07	
7	0.10	0.07	0.08	0.06
8	0.03		0.04	0.04
9		0.04	0.04	0.04
10	0.08	0.05	0.06	0.04
11	0.05	0.05	0.06	0.09
13	0.06	0.04	0.03	0.04
14	0.05	0.05	0.07	0.04
15	0.05	0.04	0.06	0.04
16		0.04		
17	0.03	0.05	0.06	
Maximum	0.16	0.11	0.11	0.10
Arithmetic mean	0.06	0.06	0.05	0.05

Arithmetic mean, all samples - 0.06
Geometric mean, all samples - 0.05

[a] Sampled by Saltzman's method.

[b] Thirty-minute samples beginning at time indicated.

Table A-5. NITRIC OXIDE,[a] ppm

Date, 1964	Time[b]			
	0830	1030	1330	1530
March 9		0.20		0.05
10	0.13	0.06		
11	0.08	0.04	0.13	0.11
12	0.05	0.10		
13	0.07	0.05	0.05	
14		0.15	0.04	0.14
16	0.16	0.04		0.12
17	0.17	0.09	0.10	0.06
18	0.07	0.05	0.04	0.04
19	0.09	0.07		0.08
20	0.12	0.06	0.14	0.12
21	0.05	0.06	0.10	0.13
23	0.08	0.04	0.04	0.02
24	0.18	0.08	0.05	0.05
25	0.26	0.07	0.06	0.06
26	0.02	0.14		0.05
27	0.07			
28	0.06	0.03	0.01	0.02
30	0.15	0.04		0.06
31	0.06	0.10		0.11
April 1	0.10	0.06	0.05	0.05
2	0.14	0.07		
3	0.14	0.06	0.08	0.14
4	0.04	0.03	0.04	0.02
6	0.04	0.05	0.05	
7	0.12	0.19	0.12	0.29
8	0.46		0.05	0.07
9		0.05	0.05	0.04
10	0.10	0.04	0.06	0.05
11	0.03	0.03	0.03	0.03
13	0.06	0.02	0.05	0.03
14	0.08	0.06	0.08	0.04
15	0.02	0.03	0.03	0.04
16		0.03		
17	0.07	0.04	0.05	
Maximum	0.46	0.20	0.14	0.29
Arithmetic mean	0.11	0.07	0.07	0.08

Arithmetic mean, all samples - 0.09
Geometric mean, all samples - 0.07

[a]Sampled by Saltzman's method.

[b]Thirty-minute samples beginning at time indicated.

GPO 817-288-6

Table A-6. ALDEHYDES,[a] ppm

Date, 1964	Time[b] 0830	1030	1330	1530
March 9		0.06		0.04
10	0.01	0.01	0.01	
11	0.04	0.13	0.04	0.04
12	0.04	0.04		
13	0.04	0.04	0.04	0.04
14		0.02	0.02	0.02
16	0.19	0.20		0.03
17	0.02	0.04	0.03	0.02
18				
19				
20	0.03	0.02	0.05	0.03
21	0.02	0.02	0.04	0.04
23	0.02		0.02	0.02
24	0.03	0.02	0.02	0.02
25	0.05	0.05	0.04	0.06
26	0.04	0.04		0.04
27	0.03			
28	0.19	0.03	0.03	0.04
30	0.09	0.05		0.03
31	0.11	0.04		0.03
April 1	0.11	0.03	0.04	0.04
2	0.08	0.02		
3	0.10	0.06	0.05	0.04
4	0.07	0.02	0.01	0.03
6	0.06	0.04	0.02	
7	0.01	0.04	0.02	0.05
8	0.11		0.03	0.02
9		0.03	0.01	0.02
10	0.03	0.04	0.00	0.01
11	0.04	0.02	0.03	0.04
13	0.01	0.02	0.02	0.01
14	0.04	0.03	0.02	0.02
15	0.10		0.06	0.03
16	0.18	0.05		
17	0.04	0.16	0.16	
Maximum	0.19	0.20	0.16	0.06
Arithmetic mean	0.06	0.05	0.03	0.03

Arithmetic mean, all samples - 0.04
Geometric mean, all samples - 0.03

[a]Sampled by MBTH method.

[b]Thirty-minute samples beginning at time indicated.

Appendix B
Data Collected by
Automatic Methods

Preceding page blank

Table B-1. SOILING INDEX, Cohs/1000 ft

Date, 1964		Time, beginning of sample					
		0000	0200	0400	0600	0800	1000
March	1	1.300	2.800	3.400	3.000	2.800	2.300
	2	.500	.400	.800	1.800	1.400	1.200
	3	1.600	2.000	2.500	3.600	3.000	.500
	4	2.100	2.100	2.500	3.100	5.100	2.100
	5	1.500	1.900	1.200	2.700	1.800	1.200
	6	.400	.700	.700	1.400	1.500	1.500
	7	1.600	1.200	.900	1.100	1.900	2.100
	8	3.500	2.600	2.600	1.900	1.000	.600
	9	1.800	1.300	1.400	4.300	5.100	5.800
	10	2.200	1.800	1.800	2.500	2.600	1.100
	11	.800	.400	.500	1.000	1.300	1.500
	12	1.100	1.000	.700	.700	.800	1.500
	13	1.500	1.900	1.500	2.100	3.500	.900
	14	1.500	1.800	1.000	1.400	1.300	2.300
	15	1.300	1.100	.800	.700	.500	.700
	16	1.300	1.300	3.000	4.000	2.200	1.300
	17	1.600	1.800	1.500	3.400	1.300	1.000
	18	.200	.100	.800	1.100	1.000	.700
	19	.800	1.000	.700	2.300	1.300	.500
	20	1.400	.800	1.100	1.800	1.600	1.000
	21	1.300	.900	.600	.500	1.300	1.000
	22	1.000	.700	.300	.300	.800	.700
	23	1.000	.600	.400	.800	1.400	.700
	24	2.800	2.100	3.000	4.300	3.800	1.200
	25	2.600	3.400	4.600	4.400	2.700	2.600
	26	2.000	2.200	2.200	1.600	1.800	1.400
	27	.500	.600	.700	1.000	1.300	.500
	28	.800	.500	1.600	1.200	1.300	.500
	29	1.100					
April	1						
	2	1.600	2.100	2.300	2.600	1.500	1.800
	3						1.300
	4	.500	.500	.700	1.100	.800	.800
	5	1.300	2.500	2.500	1.200	1.100	1.200
	6	.600	.600	.700	.800	1.400	1.400
	7	.200	.700	1.000	3.400	3.500	4.400
	8	1.000	1.400	2.300	3.100	3.400	1.800
	9	.300	.700	.400	.800	1.300	1.200
	10	2.100	2.200	1.400	4.200	.400	.200
	11		.500	1.000	.800	.700	.800
	12	1.500	1.200	1.200	.200	.500	1.000
	13	.600	.800	.500	1.100	1.300	1.800
	14	.200	1.500	1.000	.800	.800	1.400
	15	1.900	1.100	2.100	1.400	.700	.200
	16	.300	.400	.800	1.300		
Hourly avg		1.267	1.314	1.445	1.936	1.780	1.374
Hourly max		3.500	3.400	4.600	4.800	5.100	5.800

Continued on next page

Table B-1. SOILING INDEX, Cohs/1000 ft
(continued)

Date, 1964		Time, beginning of sample 1200	1400	1600	1800	2000	2200	Daily avg	Daily max
March	1	1.000	1.300	2.200	2.600	2.500	1.300	2.208	3.400
	2	1.000	.800	.900	1.900	1.500	1.800	1.183	1.900
	3	.400	.700	2.700	2.000	1.800	1.500	1.858	3.600
	4	2.100	3.500	2.700	1.600	1.300	1.400	2.467	5.100
	5	1.500	.900	1.400	.700	.400	.400	1.300	2.700
	6	1.400	1.200	2.100	2.200	2.100	2.500	1.475	2.500
	7	1.200	.500	1.100	2.500	2.700	3.800	1.717	3.800
	8	.500	1.000	1.300	.800	1.200	1.100	1.508	3.500
	9	1.500	2.100	3.000	1.300	.500	1.300	2.450	5.800
	10	.300	.800	.500	.900	.500	.700	1.308	2.600
	11	.800	.500	1.000	1.200	1.300	1.600	.992	1.600
	12	1.800	2.200	2.100	2.100	1.600	1.200	1.400	2.200
	13	1.200	1.600	2.500	2.600	1.900	1.500	1.892	3.500
	14	2.100	1.900	2.300	1.300	1.500	1.300	1.642	2.300
	15	1.400	1.000	.800	1.800	1.300	2.700	1.175	2.700
	16	1.100	.700	2.000	2.600	2.500	2.100	2.008	4.000
	17	1.500	1.300	1.500	1.300	.500	.300	1.417	3.400
	18	1.300	.800	2.100	1.300	1.900	1.000	1.025	2.100
	19	1.000	.900	1.900	1.100	1.200	1.000	1.142	2.300
	20	2.200	3.500	2.700	1.800	2.200	1.900	1.833	3.500
	21	3.000	1.600	1.000	1.200	1.300	.500	1.183	3.000
	22	.400	.300	.600	1.000	1.500	1.300	.742	1.500
	23	.300	.700	.800	1.600	1.800	2.200	1.025	2.200
	24	1.800	1.800	1.800	2.700	1.900	2.600	2.525	4.800
	25	2.100	1.600	2.500	1.800	1.600	1.500	2.617	4.600
	26	1.200	1.000	.900	.400	.200	.400	1.275	2.200
	27	.600	.500	1.400	.800	1.200	1.800	.908	1.800
	28	.600	.500	.200	.900	1.500	1.300	.908	1.600
	29							1.100	1.100
April	1			2.100	1.600	2.300	2.200	2.050	2.300
	2	1.300	1.000					1.775	2.600
	3	1.800	1.500	1.500	.900	.800	1.000	1.257	1.800
	4	.500	.300	.800	.800	1.400	1.400	.800	1.400
	5	.800	.700	.600	.900	.600	.400	1.150	2.500
	6	1.600	1.600	1.200	1.300	1.000	.600	1.067	1.600
	7	4.300	4.200	4.300	4.800	1.000	1.900	2.808	4.800
	8	1.000	.800	1.300	1.000	1.100	.900	1.592	3.400
	9	.900	.700	1.000	1.300	1.000	1.600	.933	1.600
	10	.400	1.000	1.300	1.300	1.400	1.500	1.450	4.200
	11	.800	1.200	1.300	1.500	1.500	1.400	1.183	2.700
	12	.200	.900	.800	.200	.700	.600	.750	1.500
	13	1.000	.800	.500	.700	1.000	1.000	.925	1.800
	14	1.000	2.100	2.200	.900	1.400	1.500	1.233	2.200
	15	.300	.400	.500	.500	.400	.200	.808	2.100
	16							.700	1.300
Hourly avg		1.219	1.248	1.557	1.469	1.357	1.416		
Hourly max		4.300	4.200	4.300	4.800	2.700	3.800		

Arithmetic mean, all observations - 1.45

Geometric mean, all observations - 1.19

Table B-2. SULFUR DIOXIDE, ppm

Date, 1964	Time, beginning of sample											
	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100
March 6												
7	.126	.144	.088	.067	.057	.071	.073	.056	.082	.059	.090	.063
8	.180	.167	.100	.109	.124	.100	.085	.094	.089	.062	.077	.075
9	.080	.081	.116	.137	.100	.088	.107	.116	.147	.161	.183	.239
10	.123	.210	.199	.184	.163	.201	.181	.228	.202	.144	.100	.051
11	.034	.035	.037	.032	.037	.029	.037	.032	.034	.050	.035	.036
12	.071	.057	.064	.064	.056	.054	.050	.053	.054	.081	.067	.063
13	.047	.044	.052	.043	.056	.053	.074	.081	.052	.053	.049	.047
14	.043	.051	.043	.043	.085	.088	.086	.094	.104	.055	.055	.057
15	.063	.046	.060	.065	.056	.042	.042	.044	.045	.041	.044	.044
16												
17	.107	.130	.088	.121	.097	.123	.082	.139	.069	.057	.042	.036
18	.036	.038	.036	.035	.035	.030	.038	.034	.033	.039	.046	.042
19	.035	.036	.033	.036	.032	.033	.049	.045	.036	.048	.042	.027
20	.031	.039	.035	.039	.041	.039	.046	.047	.046	.048	.030	.035
21	.053	.051	.071	.049	.068	.039	.041	.048	.059	.053	.041	.054
22	.032	.030	.032	.040	.031	.041	.032	.039	.037	.039	.036	.043
23	.035	.040	.038	.047	.043	.042	.062	.050	.047	.043	.034	.037
24	.100	.074	.095	.116	.128	.135	.184	.196	.168	.060	.056	.073
25	.067	.077	.083	.074	.105	.120	.116	.101	.075	.073	.067	.070
26	.059	.049	.080	.088	.101	.132	.057	.065	.057	.065	.094	.049
27	.032	.038	.037	.030	.029	.030	.030	.027	.035	.046	.060	.048
28	.061	.052	.058	.069	.082	.084	.099	.052	.052	.068	.051	.047
29	.055	.055	.052	.055	.055	.052	.055	.055	.049	.043	.051	.042
30	.037	.050	.044	.034	.037	.042	.037	.048	.068	.065	.071	.058
31	.043	.031	.035	.043	.042	.026	.033	.040	.036	.040	.061	.050
April 1	.043	.036	.044	.038	.037	.047	.045	.044	.044	.045	.041	.031
2												
3	.083	.083	.057	.053	.059	.060	.097	.104	.069	.081	.050	.069
4	.035	.038	.042	.038	.043	.041	.041	.042	.043	.045	.044	.042
5	.062	.066	.071	.086	.096	.110	.069	.074	.061	.061	.074	.067
6	.081	.060	.063	.051	.060	.055	.059	.061	.069	.073	.069	.070
7	.061	.056	.051	.049	.062	.083	.078	.101	.130	.166	.130	.120
8	.063	.063	.068	.061	.070	.077	.060	.105	.131	.090	.090	.067
9	.042	.041	.040	.037	.038	.037	.040	.035	.041	.051	.049	.042
10	.042	.053	.076	.052	.070	.065	.072	.072	.045	.044	.038	.047
11	.061	.089	.071	.054	.049	.055	.064	.063	.058	.044	.036	.044
12	.076	.076	.083	.073	.065	.067	.048	.067	.043	.056	.070	.066
13	.065	.058	.053	.058	.061	.056	.058	.052	.057	.084	.073	.084
14		.071	.079	.079	.092	.085	.071	.063	.071	.052	.046	.057
15	.113	.089	.074	.077	.074	.079	.076	.056	.054	.048	.047	.037
16	.044	.037	.041	.038	.038	.057	.047	.056	.040	.039	.040	.040
17	.077	.072	.061	.088	.069	.083	.081	.065	.076	.059	.055	.044
Hourly avg	.064	.065	.064	.064	.066	.069	.068	.071	.068	.063	.061	.058
Hourly max	.180	.210	.199	.184	.163	.201	.184	.228	.202	.166	.183	.239

Continued on next page

Table B-2. SULFUR DIOXIDE, ppm
(continued)

Date, 1964	Time, beginning of sample 1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	Daily avg	Daily max[a]
March 6			.042	.045	.089	.087	.144	.187	.126	.151	.242	.161	.127	.250
7	.057	.065	.074	.067	.063	.082	.104	.108	.079	.090	.090	.124	.082	.144
8	.075	.062	.081	.076	.083	.066	.076	.072	.067	.083	.057	.062	.088	.187
9	.118	.074	.079	.073	.082	.090	.125	.131	.099	.126	.137	.137	.118	.248
10	.056	.042	.038	.040	.042	.057	.059	.056	.050	.051	.046	.044	.107	.236
11	.031	.030	.033	.035	.039	.043	.052	.069	.048	.049	.055	.063	.041	.086
12	.062	.052	.052	.057	.046	.041	.052	.058	.046	.043	.056	.042	.056	.086
13	.061	.084	.076	.071	.053	.066	.066	.101	.065	.047	.050	.042	.060	.121
14	.056	.058	.048	.063	.066	.071	.061	.066	.058	.061	.051	.059	.063	.119
15	.044	.039	.042	.052	.041	.043	.051	.047					.048	.072
16	.033	.034	.036	.031	.037	.046	.051	.058	.056	.073	.059	.075	.049	.088
17	.034	.044	.037	.028	.025	.043	.045	.037	.044	.045	.036	.042	.065	.155
18	.046	.042	.052	.045	.041	.045	.041	.045	.046	.039	.034	.034	.040	.058
19	.024	.031	.036	.026	.033	.039	.036	.033	.040	.047	.043	.037	.037	.058
20	.041	.060	.115	.124	.171	.142	.123	.147	.157	.184	.142	.075	.082	.192
21	.040	.043	.050	.051	.052	.053	.042	.039	.036	.033	.036	.035	.047	.102
22	.032	.030	.041	.034	.045	.047	.043	.048	.043	.049	.041	.038	.038	.049
23	.033	.044	.038	.043	.044	.047	.049	.048	.070	.107	.175	.087	.054	.249
24	.066	.049	.037	.050	.046	.076	.068	.074	.085	.089	.110	.090	.093	.261
25	.068	.066	.050	.060	.065	.068	.059	.059	.077	.057	.068	.057	.074	.130
26	.087	.062	.040	.038	.047	.048	.036	.045	.043	.043	.037	.035	.061	.177
27	.044	.053	.049	.049	.055	.046	.042	.053	.053	.051	.052	.059	.044	.075
28	.053	.046	.054	.063	.053	.059	.052	.070	.054	.048	.069	.056	.061	.110
29	.043	.042	.031	.036	.033	.043	.039	.037	.045	.046	.057	.056	.047	.059
30	.042	.032	.039	.052	.056	.049	.045	.055	.030	.039	.043	.037	.046	.078
31	.030	.033	.035	.038	.054	.051	.053	.045	.045	.059	.058	.057	.043	.062
April 1	.039	.054	.056	.045	.044	.044							.043	.061
2	.052	.059	.062	.046	.057	.051	.051	.070	.081	.067	.052	.075	.060	.099
3	.058	.061	.054	.044	.042	.048	.044	.048	.042	.049	.043	.034	.060	.121
4	.050	.051	.050	.060	.067	.054	.039	.045	.082	.045	.065	.066	.049	.088
5	.059	.054	.060	.055	.047	.057	.065	.073	.083	.084	.070	.055	.069	.130
6	.070	.071	.082	.082	.070	.056	.057	.062	.073	.062	.084	.060	.067	.100
7	.146	.104	.135	.084	.107	.118	.117	.122	.082	.071	.059	.064	.096	.185
8	.053	.053	.058	.036	.035	.040	.043	.041	.040	.049	.048	.043	.062	.144
9	.042	.048	.043	.052	.046	.044	.044	.044	.041	.042	.048	.042	.043	.053
10	.039	.039	.038	.035	.047	.045	.046	.046	.055	.047	.061	.055	.051	.080
11	.046	.057	.060	.069	.082	.077	.062	.090	.083	.071	.089	.056	.064	.108
12	.053	.046	.051	.053	.055	.074	.055	.055	.067	.072	.073	.062	.063	.092
13	.059	.068	.077	.059	.068	.059	.117	.124	.138	.097	.102	.084	.075	.157
14	.060	.079	.078	.086	.086	.102	.115	.083	.100	.121	.086	.113	.081	.132
15	.041	.044	.043	.040	.039	.043	.044	.053	.054	.052	.051	.045	.057	.117
16	.042	.040	.038	.033	.046	.037	.070	.110	.084	.081	.053	.050	.050	.132
17	.049	.050	.055										.066	.093
Hourly avg	.053	.052	.055	.053	.057	.059	.063	.070	.067	.068	.071	.063		
Hourly max	.146	.104	.135	.124	.171	.142	.144	.187	.157	.184	.242	.161		

Arithmetic mean, all observations - 0.063

Geometric mean, all observations - 0.057

a. One-half hour maximum value

Table B-3. CARBON MONOXIDE, ppm

Date, 1964	Time, beginning of sample											
	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100
March 9												
10	4.150	2.300	3.000	2.100	1.100	1.850	2.450	5.150	8.150	6.550	6.900	7.400
11												
12	4.050	3.200	4.450	3.700	4.600	3.650	3.450	4.550	5.450	5.200	6.100	7.650
13	3.650	3.850	3.100	2.400	2.550	2.300	1.950	2.450	3.650	8.650	9.900	7.400
14	3.850	4.750	4.500	2.700	2.750	2.550	3.350	4.300	4.750	6.000	7.700	7.900
15	5.550	6.500	7.050	4.400	2.800	2.050	2.200	2.050	1.350	.900	.900	1.350
16	3.300	3.300	4.600	2.950	2.500	2.450	5.000	9.100			3.050	2.600
17	4.900	2.250	3.300	1.350	1.050	.850	3.250	7.400	11.000	6.200	4.800	4.250
18	1.100	1.100	1.050	.950	.850	.900	1.650	3.300	5.150	3.950	4.450	3.900
19	1.000	.850	.900	.850	1.000	.900	1.900	4.900	4.750	5.400	5.300	3.800
20	1.100	.650	.750	.850	1.000	1.050	1.900	4.050	4.700	4.000	4.500	3.550
21	4.550	2.700	4.350	1.950	1.350	1.450	1.650	3.000	2.550	3.350	2.550	2.350
22	2.300	.800	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
23	1.650	1.300	2.750	1.300	2.450	2.900	4.750	6.550	7.650	6.650	6.450	6.600
24	2.100	2.250	3.850	2.650	1.750	3.700	5.200	6.400	4.200	4.800	5.800	6.150
25	4.950	5.400	9.350	6.150	5.400	5.850	9.650	14.350	10.850	9.250	10.600	9.350
26	9.300	7.700	8.350	7.250	7.400	7.900	8.750	12.350	15.000	9.450	8.850	8.450
27	.900	.900	.900	.900	.900	.900	.900	.900	1.850	3.000	3.900	3.400
28	2.950	.900	1.000	1.000	1.000	1.000	1.000	1.000	2.000	2.250	4.350	3.350
29	5.500	5.500	6.200	5.700	5.050	5.300	5.650	4.850	4.750	4.900	5.450	5.300
30	6.050	6.700	6.700	6.500	6.600	6.150	6.900	8.400	8.600	8.950	8.050	7.400
31	2.500	2.350	2.350	1.900	2.500	1.950	3.000	6.150	9.800	5.950	7.600	9.000
April 1	1.200	1.100	1.100	1.100	1.100	.900	2.450	3.650	6.000	4.350	3.100	3.850
2	4.600	3.850	4.700	2.150	1.950	2.600	2.950	6.450	6.550	5.550	5.450	6.050
3	2.400	1.650	3.300	1.050	1.550	1.750	5.150	6.000	8.400	6.950	6.800	8.500
4	.900	1.150	1.450	1.050	.700	1.500	1.200	2.250	1.450	2.250	1.600	2.150
5	3.750	3.900	6.900	4.100	5.400	3.700	1.250	.800	.950	1.850	1.550	1.600
6	1.100	1.000	.950	1.050	.850	1.100	1.850	4.100	4.450	3.350	3.950	2.700
7	3.400	2.400	3.300	2.050	2.300	3.950	5.450	7.650	10.650	8.200	9.200	13.100
8	6.450	5.800	5.250	6.200	5.250	3.050	7.550	10.300	19.800	15.600	16.400	15.550
9	3.800	2.600	2.600	.850	.950	1.350	3.950	4.600	5.300	7.250	6.150	6.350
10	1.000	1.750	4.650	1.800	1.300	1.150	4.850	8.450	8.300	7.900	4.700	6.450
11	10.350	8.450	4.650	2.700	4.000	2.300	3.100	3.150	1.500	1.000	2.750	4.300
12	4.450	3.950	4.650	2.750	3.200	1.550	1.700	1.650	2.300	1.400	3.400	4.700
13	5.750	4.500	5.100	4.050	5.000	4.200	5.550	7.500	8.950	8.150	8.150	9.100
14	1.900	2.350	3.050	1.850	1.650	1.600	2.650	5.950	8.250	8.600	8.300	9.400
15	4.900	6.750	4.850	3.300	3.900	6.250	5.600	7.050	9.350	6.150	4.900	8.500
16	4.900	4.800	4.300	3.900	3.850	5.000	5.550	7.450	7.350	6.850	7.250	6.550
17		.850	1.950	1.650	.950	2.250	4.850	7.600	10.600	8.950	9.150	7.450
Hourly avg	3.682	3.213	3.743	2.636	2.618	2.654	3.716	5.442	6.415	5.696	5.816	6.012
Hourly max	10.350	8.450	9.350	7.250	7.400	7.900	9.650	14.350	19.800	15.600	16.400	15.550

Continued on next page

GPO 817-228-5

Table B-3. CARBON MONOXIDE, ppm
(continued)

Date, 1964	Time, beginning of sample												Daily avg	Daily max[a]
	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300		
March 9	12.250	8.450	11.400	8.600	12.250	13.100	12.850	5.800	5.600	5.150	4.400	5.750	8.800	15.700
10	5.450	6.750	6.700	8.250	5.650	5.750	1.850						4.816	9.000
11	9.700	9.900	8.950	9.450	10.250	11.900	10.500	8.350	5.600	5.350	4.850	4.800	8.300	12.600
12	6.950	7.550	6.950	10.500	9.650	8.450	10.200	11.250	8.100	7.700	4.650	4.200	6.342	13.200
13	6.800	5.550	6.250	5.100	5.500	6.700	5.750	5.200	5.750	4.500	3.100	3.300	4.806	11.100
14	7.350	7.300	5.950	7.200	7.200	5.400	4.850	5.300	5.650	4.950	5.250	4.150	5.235	8.900
15	1.500	2.800	3.200	4.900	3.350	3.400	4.400	4.050	5.350	4.050	4.900	4.800	3.492	7.300
16	2.900	2.950	4.550	6.200	11.550	10.550	8.900	7.200	6.300	4.000	3.150	3.800	5.041	12.300
17	3.550	5.550	7.350	5.600	4.750	7.050	5.000	3.300	1.350	1.000	1.000	1.100	4.050	11.200
18	4.400	4.500	5.450	4.150	6.800	8.900	4.700	3.250	2.500	1.650	1.800	1.700	3.256	9.100
19	3.300	5.800	4.150	4.000	6.300	8.150	4.000	2.450	1.600	1.700	1.100	.900	3.125	11.100
20	5.200	6.300	5.950	6.700	8.750	10.300	4.350	2.750	3.300	2.750	3.500	2.900	3.785	11.800
21	3.500	4.750	4.200	7.350	4.750	3.700	1.950	2.600	2.250	2.300	1.650	2.400	3.050	7.900
22	1.250	.850	.950	1.000	1.000	1.000	1.200	2.000	1.900	2.000	2.350	1.550	1.256	2.800
23	6.400	3.900	3.800	2.700	5.450	4.850	2.600	2.800	1.900	1.950	1.850	3.500	3.863	7.800
24	5.650	4.500	4.200	4.400	4.750	7.900	5.000	3.400	4.250	3.800	3.500	4.450	4.360	8.000
25	8.350	8.400	8.250	8.750	10.700	12.100	9.200	7.450	7.600	9.200	8.300	8.500	8.665	15.700
26	8.900	9.750	6.350	5.200	6.550	7.300	3.750	1.900	2.800	1.700	1.700	.800	6.977	15.500
27	3.350	2.500	2.500	2.050	2.850	2.750	.900	1.100	1.550	.900	1.950	3.200	1.873	4.900
28	4.050	4.050	3.450	3.650	3.500	1.650	2.450	2.850	3.450	3.050	4.800	4.950	2.654	5.800
29	5.200	6.500	5.200	6.150	6.650	6.450	6.800	7.600	7.250	7.300	6.800	6.850	5.954	7.800
30	8.050	6.800	6.700	6.700	5.800	7.600	4.550	2.700	2.300	3.450	1.600	2.600	6.077	9.700
31	4.900	7.050	8.200	8.100	7.650	8.250	5.450	2.550	3.150	2.700	1.350	1.250	4.819	9.800
April 1	5.650	4.500	3.550	2.450	3.250	8.550	4.500	3.900	4.600	5.100	3.850	6.400	3.592	9.600
2	7.250	6.250	5.500	6.250	8.300	10.050	4.000	2.650	2.550	2.100	1.650	2.450	4.660	10.400
3	8.300	8.500	7.300	5.450	9.950	3.000	2.400	1.650	1.750	1.500	.950	1.650	4.413	11.300
4	1.600	1.300	1.900	2.200	1.900	2.200	1.850	2.500	2.600	4.650	4.550	5.300	2.092	6.100
5	1.100	.800	1.150	.900	.750	1.000	1.800	1.700	1.600	2.000	1.350	1.550	2.144	7.700
6	3.650	3.400	4.600	4.200	5.450	5.200	4.600	3.800	2.450	2.050	3.400	2.250	2.979	6.300
7	10.500	6.300	10.300	8.050	11.950	15.300	17.350	18.400	10.050	7.250	5.800	6.350	8.302	20.800
8	13.400	6.550	7.000	6.350	7.450	8.500	6.400	4.100	3.350	4.550	4.150	3.550	8.023	20.800
9	6.600	5.450	4.000	3.900	5.700	6.700	3.650	2.650	1.450	3.250	2.150	1.450	3.863	7.600
10	5.600	6.050	8.900	8.250	10.350	15.900	8.400	6.400	5.300	6.650	6.250	5.600	6.081	16.700
11	5.400	4.600	6.400	5.900	6.250	4.750	5.250	4.700	5.800	4.550	5.550	5.150	4.690	11.600
12	4.350	3.350	3.850	4.850	4.800	5.300	4.700	6.650	6.550	5.200	4.800	4.300	3.933	7.500
13	4.200	5.750	4.750	3.400	3.300	5.550	4.500	2.350	2.400	2.000	3.150	2.700	5.002	9.800
14	8.150	8.400	10.600	8.700	7.750	9.650	6.450	5.200	4.250	4.850	6.700	5.850	5.921	11.200
15	9.100	8.150	9.050	7.900	10.100	9.350	8.100	8.200	8.700	7.050	7.950	7.950	7.213	11.400
16	5.650	7.400	6.650	8.400	10.350	11.900	7.000	2.800	4.000	4.000	3.300	2.150	5.890	13.000
17	8.350	9.000	7.300	7.250	9.800							1.300	5.838	11.600
Hourly avg	5.945	5.705	5.836	5.778	6.726	7.336	5.440	4.566	4.129	3.892	3.661	3.677		
Hourly max	13.400	9.900	11.400	10.500	12.250	15.900	17.350	18.400	10.050	9.200	8.300	8.500		

Arithmetic mean, all observations - 4.77

Geometric mean, all observations - 3.77

a. One-half hour maximum value

Table B-4. CARBON DIOXIDE, ppm

Date, 1964		Time, beginning of sample											
		0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100
March	7	335.500	344.000	329.000	328.500	320.000	320.000	322.000	328.500	336.500	336.000	338.500	335.000
	8	450.500	422.500	372.000	399.000	413.500	395.000	375.500	375.000	357.500	349.000	351.500	348.500
	9	368.000	366.500	387.500	376.000	376.000	390.500	391.500	409.500	438.500	411.000	426.500	399.500
	10	349.000	352.000	349.500	337.000	342.500	348.000	348.500	368.000	371.500	349.500	315.500	330.000
	11	304.500	296.500	301.500	289.000	290.000	291.500	303.000	310.000	321.500	367.500	365.500	375.500
	12	349.500	350.000	348.500	348.500	349.000	348.000	361.500	365.500	381.500	394.000	385.500	381.500
	13	340.000	337.000	348.000	336.500	349.500	360.000	376.000	382.500	375.500	372.000	368.500	382.500
	14	362.000	368.000	366.500	359.000	362.000	355.000	361.500	374.000	371.000	370.500	347.500	368.500
	15	347.500	349.000	355.000	350.500	344.000	342.000	351.000	346.000	336.000	337.000	332.500	334.500
	16	366.000	369.500	377.500	360.000	365.000	375.000	365.500	389.500	410.000	359.500	342.500	344.000
	17	359.000	358.000	347.500	353.000	330.500	333.000	331.500	367.500	364.500	331.500	310.500	304.000
	18	258.000	265.000	270.500	261.000	257.000	262.000	275.000	281.500	278.500	304.500	347.500	357.500
	19	309.500	312.500	314.000	311.500	316.500	317.000	331.500	341.000	353.500	387.500	360.000	336.500
	20	313.000	314.500	302.500	313.500	308.500	315.000	322.000	330.000	330.500	353.500	346.500	345.000
	21	374.000	350.000	359.500	360.000	360.000	343.000	340.000	351.500	386.000	386.000	343.000	382.500
	22	360.000	358.500	343.000	343.500	334.500	348.000	345.500	357.000	355.000	349.500	350.000	351.500
	23	360.500	361.500	372.500	360.500	368.000	383.000	391.500	392.000	394.000	380.500	367.000	359.500
	24	388.000	366.000	394.500	471.500	478.000	486.500	475.500	443.500	399.500	390.500	361.000	360.000
	25	352.000	371.000	392.000	402.000	459.000	460.500	471.000	433.000	396.500	372.500	382.000	374.000
	26	354.000	345.000	362.000	366.500	376.000	372.500	359.000	377.500	384.000	364.500	358.000	330.500
	27	301.000	302.000	303.000	301.000	300.500	297.500	298.500	300.500	298.500	358.500	412.000	435.000
	28	366.500	367.500	356.000	358.000	360.000	373.500	368.500	355.000	370.000	371.500	344.500	343.500
	29	351.000	360.000	354.500	351.500	355.000	369.000	360.000	359.500	354.000	360.500	352.000	344.000
	30	346.500	348.000	343.000	349.000	349.000	351.500	361.000	393.000	400.500	478.500	418.500	442.000
	31	337.000	329.000	334.500	327.500	327.500	326.000	350.000	359.000	368.000	399.000	430.000	396.500
April	1	322.000	328.000	324.500	322.500	329.000	334.500	342.000	337.500	364.000	392.000	379.500	341.500
	2	378.000	360.500	356.000	355.000	348.500	343.500	342.000	346.500	359.500	366.500	390.500	369.500
	3	336.500	317.500	333.000	323.500	342.500	340.500	356.000	357.000	348.500	347.000	328.000	347.500
	4	324.500	320.000	319.500	319.500	322.500	324.000	334.000	328.500	342.000	351.000	357.500	350.500
	5	346.500	361.500	402.000	418.000	451.500	425.000	340.000	323.000	319.000	320.000	344.500	343.500
	6	322.000	316.000	326.000	320.500	318.000	322.500	334.500	338.500	361.500	386.000	412.500	396.500
	7	335.000	328.500	340.000	327.500	337.000	357.000	366.500	388.500	395.000	399.000	401.000	448.000
	8	392.500	395.000	385.000	400.000	415.500	399.000	428.000	417.000	460.500	422.000	414.000	370.000
	9	321.500	315.500	321.000	312.500	315.500	319.500	321.000	325.500	373.500	392.500	399.500	349.000
	10	342.500	345.500	370.000	378.500	367.500	361.500	375.500	379.000	369.000	372.000	347.000	357.000
	11	413.000	449.500	399.000	392.500	399.500	406.500	393.500	392.500	375.500	358.500	325.500	347.500
	12	348.500	345.500	345.000	343.500	363.000	352.500	358.500	337.500	348.500	348.000	367.000	371.500
	13	384.000											367.500
	14	316.500	313.500	316.500	313.000	315.000	318.000	314.000	328.000	337.000	323.500	338.000	345.500
	15		408.500	395.000	395.500	396.500	427.000	396.500	384.000	393.500	352.500	330.000	339.500
	16	365.500	357.000	350.000	338.500	339.500	360.000	358.500	367.500	361.000	357.500	352.500	337.500
	17	360.000	351.500	359.000	352.500	351.500	368.000	382.000	397.500	421.000	394.500	374.000	350.000
Hourly avg		349.049	348.220	349.402	349.439	353.756	356.634	358.024	361.902	367.354	368.707	363.841	361.750
Hourly max		450.500	449.500	402.000	471.500	478.000	486.500	475.500	443.500	460.500	478.500	430.000	448.000

Continued on next page

Table B-4. CARBON DIOXIDE, ppm
(continued)

Date, 1964		Time, beginning of sample 1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	Daily avg	Daily[a] max
March	7	331.500	335.000	342.300	335.500	339.000	338.500	351.000	351.500	363.000	374.000	365.500	405.500	341.917	428.000
	8	345.500	335.000	361.500	360.000	403.500	376.500	365.500	359.000	355.000	356.500	358.000	357.000	372.604	451.000
	9	361.500	367.500	368.000	370.000	363.500	362.500	363.000	352.000	342.500	351.500	361.000	349.000	377.208	449.000
	10	326.000	326.500	324.000	324.500	337.000	332.000	325.500	319.500	315.000	313.000	306.000	306.000	334.000	390.000
	11	371.000	368.300	376.500	381.500	398.000	408.000	379.000	372.500	360.500	355.500	359.500	350.500	345.708	426.000
	12	381.000	391.000	427.500	458.000	417.500	385.000	373.000	385.000	359.000	342.000	343.500	336.000	373.396	465.000
	13	394.500	448.500	407.000	420.000	389.000	379.500	360.500	367.500	361.500	355.500	367.000	361.500	372.500	467.000
	14	374.000	376.500	390.000	369.500	397.500	376.000	360.500	359.500	348.500	355.000	352.500	344.500	365.396	412.000
	15	339.500	336.500	344.500	346.500	335.000	343.000	344.000	349.500	360.500	374.500	372.000	387.000	348.229	392.000
	16	334.000	331.500	339.000	347.500	364.500	388.500	388.000	385.000	352.500	358.000	335.500	341.500	362.063	412.000
	17	302.500	331.000	313.000	298.500	277.000	309.000	314.500	284.500	279.500	277.000	271.000	276.500	317.688	378.000
	18	359.000	373.000	374.000	391.500	359.500	359.500	340.000	339.500	335.000	326.000	327.000	321.500	317.646	418.000
	19	297.000	362.500	395.000	319.000	345.000	328.500	321.000	313.500	329.000	312.500	309.500	303.000	330.271	439.000
	20	383.500	419.500	403.500	431.000	397.000	390.000	373.000	360.000	372.500	377.500	380.500	381.500	356.833	447.000
	21	361.000	385.000	423.000	413.000	409.500	386.500	366.500	371.500	354.500	366.000	355.000	354.000	370.042	425.000
	22	350.500	360.500	355.000	354.500	361.000	361.500	376.500	376.500	373.000	378.000	371.000	366.000	357.500	385.000
	23	364.500	394.500	387.000	369.000	382.000	366.500	370.000	360.000	371.500	366.500	372.000	390.000	374.333	402.000
	24	363.000	345.500	313.000	343.000	340.500	359.000	349.000	350.000	359.000	348.500	351.000	359.000	383.125	510.000
	25	376.000	355.500	342.000	338.500	348.000	350.000	349.000	354.000	361.500	355.500	358.500	367.000	380.042	485.000
	26	351.500	361.000	347.500	330.500	327.000	329.500	322.000	316.500	316.000	313.000	312.500	306.500	345.125	390.000
	27	392.500	371.500	367.000	367.000	369.000	360.000	349.500	354.500	366.000	350.500	366.000	379.000	345.854	442.000
	28	346.000	336.000	350.000	360.500	358.000	342.500	338.000	352.000	349.000	359.500	358.000	349.000	355.542	385.000
	29	352.000	347.000	348.000	351.000	350.000	346.500	347.500	353.500	349.000	361.000	355.000	352.500	353.500	370.000
	30	399.000	418.500	471.000	416.000	375.500	359.500	350.000	349.000	337.000	340.000	337.000	337.500	377.938	482.000
	31	347.500	360.500	358.000	391.500	421.000	425.000	376.500	349.000	341.500	336.500	333.000	332.500	360.688	440.000
April	1	371.000	468.000	456.500	451.500	371.500	361.500	328.000	327.500	330.500	336.000	336.000	337.500	358.021	487.000
	2	356.500	373.500	373.500	342.000	366.500	349.000	325.500	330.500	330.000	332.000	311.500	335.500	351.750	397.000
	3	341.000	341.500	334.000	333.500	326.000	317.000	332.500	328.500	329.000	328.000	325.000	328.000	335.063	369.000
	4	348.000	341.500	361.000	360.000	386.000	332.500	317.000	313.500	318.000	332.000	342.500	336.000	336.729	387.000
	5	334.500	335.000	333.500	324.500	317.500	320.000	325.500	327.500	326.500	326.000	327.000	322.000	346.417	468.000
	6	407.500	427.500	381.500	394.000	366.000	343.500	340.000	347.000	339.000	330.500	333.000	334.500	354.104	455.000
	7	459.000	437.000	474.500	442.500	449.000	484.000	517.000	446.000	400.000	417.500	400.000	400.000	406.229	522.000
	8	355.500	331.500	332.000	320.500	318.500	319.000	329.000	332.000	322.000	322.000	327.000	318.500	367.750	461.000
	9	375.500	391.500	362.000	345.000	321.000	334.000	315.000	321.500	311.000	326.000	325.500	327.000	338.396	401.000
	10	355.500	354.500	368.000	360.500	376.500	402.500	374.500	367.000	359.000	369.500	377.500	370.000	366.667	404.000
	11	358.000	367.500	377.500	375.500	375.000	344.000	355.500	354.000	349.500	345.500	339.500	342.000	372.354	452.000
	12	355.000	349.000	353.000	360.500	365.000	371.000	366.000	375.500	376.000	374.500	377.500	369.500	359.229	388.000
	13	338.500	326.000	311.500	315.500	303.000	328.000	336.500	331.500	327.500	329.500	323.000	322.000	331.714	384.000
	14	354.000	371.500	379.000	381.500	373.500	397.500	382.500	379.000	380.500	390.000	380.000	371.000	350.771	405.000
	15	331.500	347.000	352.500	347.500	355.000	348.000	369.500	367.500	383.000	369.000	380.000	378.000	372.750	433.000
	16	346.000	348.000	343.500	341.000	356.500	368.500	363.000	364.500	361.000	361.000	351.000	346.500	353.979	373.000
	17	345.500	348.000	366.000	361.000	383.000	376.000							368.944	437.000
Hourly avg		358.012	366.583	368.738	365.333	363.667	360.929	354.390	351.171	347.671	348.598	347.159	348.833		
Hourly max		459.000	468.000	474.500	458.000	449.000	484.000	517.000	446.000	400.000	417.500	400.000	405.500		

Arithmetic mean, all observations - 357

Geometric mean, all observations - 355

a. One-half hour maximum value

Table B-5. TOTAL HYDROCARBONS, ppm

Date, 1964		Time, beginning of sample											
		0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100
March	10									2.375	2.780	2.650	2.390
	11												
	12	1.640	1.565	1.575	1.570	1.500	1.505	1.440	1.655	1.755	1.585	1.860	2.340
	13	1.740	1.585	1.440	1.655	1.435	1.390	1.450	1.730	2.315	2.190	2.565	2.240
	14	2.155	2.100	1.740	1.805	2.025	1.975	2.070	1.900	2.095	2.090	2.090	2.170
	15	1.975	2.010	2.120	2.070	1.665	1.525	1.525	1.595	1.425	1.500	1.550	1.505
	16	1.995	1.885	1.910	2.000	2.005	1.840	1.640	2.050	3.115	2.605	2.315	2.295
	17	2.115	2.190	1.985	2.055	1.635	1.295	1.450	1.720	2.210	2.445	1.895	1.820
	18	1.085	1.005	1.150	.900	.990	1.085	1.350	1.685	1.955	2.185	2.185	1.895
	19	1.225	1.150	1.125	1.085	1.135	1.220	1.305	1.745	2.095	1.890	1.905	2.090
	20	1.815	1.675	1.675	1.550	1.490	1.540	1.670	2.045	1.990	1.870	1.995	1.960
	21												
	22	1.625	1.555	1.485	1.370	1.230	1.265	1.390	1.395	1.510	1.660	1.685	1.375
	23	1.970	1.810	1.895	1.950								
	24											2.265	2.230
	25	2.220	2.540	3.040	3.195	3.125	3.110	4.040	4.185	3.505	3.560	3.025	3.005
	26	2.680	2.420	2.435	2.290	2.085	2.205	2.310	2.645	2.980	3.060	2.735	2.305
	27	1.890	1.895	1.900	2.100	2.045	1.990	2.225	2.395	2.270	2.100	1.970	1.970
	28	1.965	1.680	1.690	1.440	1.515	1.560	1.745	1.705	1.805	1.805	1.810	1.825
	29	1.425	1.275	1.405	1.280	1.210	1.215	1.220	1.145	1.270	1.570	1.715	1.640
	30	1.555	1.420	1.595	1.395	1.445	1.500	1.630	1.795	2.530	2.525	2.475	2.110
	31	1.590	1.400	1.355	1.435	1.300	1.440	1.795	2.035	2.315	2.500	2.355	2.340
April	1	1.385	1.285	1.355	1.290	1.305	1.385	1.510	1.745	1.785	1.595	1.905	1.920
	3											2.530	2.330
	4	1.265	1.370	1.430	1.420	1.485	1.425	1.515	1.580	1.705	1.830	1.875	1.715
	5	2.175	2.745	2.445	2.475	2.600	1.810	1.725	1.715	1.800	1.780	1.810	1.850
	6	1.470	1.565	1.465	1.380	1.725	1.940	2.085	1.880	1.810	1.870	1.865	2.100
	7	2.225	2.220	2.310	2.400	1.980	2.105	2.525	3.000	3.215	3.270	3.160	4.415
	8	2.345	2.825	2.315	2.660	3.015	2.245	3.510	3.205	4.330	4.220	4.225	3.715
Hourly avg		1.814	1.799	1.785	1.782	1.737	1.677	1.875	2.024	2.257	2.270	2.247	2.213
Hourly max		2.680	2.825	3.040	3.195	3.125	3.110	4.040	4.185	4.330	4.220	4.225	4.415

Continued on next page

Table B-5. TOTAL HYDROCARBONS, ppm
(continued)

Date, 1964		Time, beginning of sample 1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	Daily avg	Daily[a] max
March	10	2.225	2.600	2.680	2.685	1.820	1.530	1.020	1.015	.790	.850	.940	1.130	1.843	3.200
	11							2.390	1.890	1.815	1.800	1.885	1.925	1.951	2.450
	12	2.200	2.160	2.780	3.040	2.400	2.865	2.580	2.095	2.195	1.740	1.530	1.660	1.968	3.160
	13	1.690	1.670	1.935	1.940	1.960	1.975	1.820	1.705	1.830	1.955	2.285	2.075	1.857	2.580
	14	2.815	2.575	2.630	2.670	2.550	2.125	2.135	2.115	2.175	1.940	2.075	2.055	2.170	2.830
	15	1.495	1.645	1.665	1.755	1.675	1.660	1.850	1.890	1.945	2.085	1.980	1.910	1.751	2.310
	16	2.525	2.250	1.830	1.810	1.580	1.785	2.280	2.215	2.845	2.780	2.280	2.105	2.164	3.420
	17	1.820	1.560	1.665	2.710	2.220	1.885	1.680	1.480	1.155	1.225	1.110	1.075	1.767	2.870
	18	1.675	1.910	1.800	1.640	1.900	2.080	1.640	1.540	1.390	1.470	1.265	1.220	1.542	2.320
	19	2.165	2.610	2.260	2.325	2.435	2.425	2.115	2.145	2.110	1.890	1.880	1.870	1.842	2.870
	20	1.975	1.900	1.900	2.005	2.495	2.090							1.869	2.500
	21							1.750	1.665	1.570	1.890	1.720	1.715	1.718	2.070
	22	1.810	2.335	2.225	2.310	2.315	2.015	2.005	1.890	1.840	1.895	1.820	1.930	1.747	2.490
	23													1.906	2.070
	24	2.150	1.905	2.130	2.335	2.195	2.420	1.970	1.935	1.965	1.640	1.735	2.125	2.071	2.480
	25	3.045	2.105	1.895	2.365	3.195	3.135	2.425	2.660	2.350	2.665	2.860	2.730	2.916	4.530
	26	2.360	2.325	1.760	1.800	2.100	2.390	1.990	1.985	1.960	1.890	1.865	2.075	2.277	3.270
	27	1.890	1.895	2.020	2.065	2.000	2.130	1.950	1.870	1.830	1.715	1.990	2.460	2.024	2.570
	28	1.845	1.800	1.750	1.570	1.330	1.345	1.360	1.100	1.255	1.105	1.310	1.220	1.564	2.260
	29	1.725	1.875	1.780	1.770	1.685	1.600	1.790	1.800	1.675	1.650	1.610	1.685	1.542	1.880
	30	2.200	2.375	2.195	2.050	2.175	1.950	1.780	1.620	1.610	1.615	1.550	1.615	1.863	2.720
	31	2.125	2.260	2.145	2.405	2.345	2.220	1.710	1.500	1.690	1.555	1.500	1.350	1.861	2.530
April	1													1.539	1.930
	3	2.310	2.270	2.250	2.260	2.365	2.015	1.900	1.630	1.555	1.445	1.425	1.565	1.989	2.760
	4	1.620	2.015	1.575	1.590	1.665	1.700	1.750	1.900	1.895	2.170	2.250	2.485	1.718	2.580
	5	1.685	1.710	1.750	1.625	1.580	1.795	1.790	1.675	1.675	1.565	1.475	1.500	1.865	2.750
	6	2.085	2.135	1.985	2.300	2.100	1.955	2.110	1.895	1.990	1.995	2.255	1.930	1.912	2.530
	7	3.495	2.535	3.515	2.900	3.685	4.110	4.430	4.800	3.120	2.220	2.000	2.280	2.996	5.070
	8	2.905	2.180	2.230	2.310	2.100								2.961	4.580
Hourly avg		2.153	2.104	2.094	2.169	2.155	2.133	2.009	1.921	1.849	1.790	1.784	1.828		
Hourly max		3.495	2.610	3.515	3.040	3.685	4.110	4.430	4.800	3.120	2.780	2.860	2.730		

Arithmetic mean, all observations - 1.98

Geometric mean, all observations - 1.91

a. One-half hour maximum value

Table B-6. TEMPERATURE, degrees F

Date, 1964	Time, beginning of measurement											
	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100
March 19												
20	32.000	32.000	31.000	31.000	30.000	30.000	30.000	23.000	22.000	36.000	39.000	42.000
21	41.000	40.000	40.000	40.000	39.000	39.000	38.000	38.000	39.000	42.000	46.000	46.000
22	46.000	45.000	44.000	45.000	45.000	43.000	42.000	40.000	40.000	39.000	38.000	38.000
23	34.000	34.000	34.000	34.000	35.000	35.000	35.000	36.000	36.000	38.000	40.000	45.000
24	42.000	43.000	42.000	47.000	41.000	40.000	40.000	39.000	41.000	43.000	46.000	49.000
25	54.000	54.000	54.000	54.000	53.000	53.000	52.000	52.000	52.000	54.000	60.000	65.000
26	63.000	63.000	63.000	62.000	62.000	61.000	61.000	61.000	60.000	62.000	63.000	67.000
27	41.000	40.000	38.000	38.000	37.000	37.000	36.000	35.000	36.000	38.000	40.000	43.000
28	49.000	45.000	44.000	43.000	42.000	41.000	41.000	41.000	44.000	46.000	50.000	53.000
29	46.000	48.000	46.000	47.000	46.000	47.000	47.000	48.000	47.000	46.000	48.000	50.000
30	39.000	41.000	40.000	39.000	37.000	38.000	38.000	36.000	35.000	34.000	33.000	33.000
31	29.000	28.000	27.000	27.000	27.000	27.000	27.000	30.000	32.000	34.000	37.000	38.000
April 1	35.000	35.000	34.000	33.000	33.000	33.000	33.000	34.000	36.000	38.000	40.000	41.000
2	38.000	37.000	37.000	35.000	34.000	34.000	34.000	37.000	40.000	43.000	43.000	46.000
3	46.000	46.000	46.000	45.000	45.000	48.000	51.000	58.000	60.000	64.000	68.000	67.000
4	38.000	36.000	34.000	33.000	32.000	32.000	32.000	34.000	36.000	40.000	44.000	46.000
5	42.000	42.000	40.000	39.000	39.000	37.000	36.000	38.000	40.000	44.000	48.000	50.000
6	47.000	47.000	47.000	46.000	46.000	45.000	44.000	44.000	44.000		42.000	42.000
7	48.000	48.000	49.000	49.000	50.000	50.000	51.000	52.000	53.000	53.000	54.000	55.000
8	61.000	61.000	61.000	60.000	59.000	59.000	59.000	61.000	61.000	62.000	62.000	61.000
9	43.000	42.000	41.000	40.000	40.000	41.000	42.000	40.000	42.000	46.000	48.000	49.000
10	46.000	45.000	44.000	42.000	42.000	45.000	49.000	54.000	55.000	59.000	62.000	64.000
11	51.000	51.000	50.000	49.000	49.000	49.000	53.000	56.000	58.000	62.000	63.000	63.000
12	53.000	52.000	50.000	47.000	47.000	47.000	50.000	54.000	58.000	62.000	62.000	63.000
13	60.000	58.000	58.000	58.000	56.000	54.000	54.000	54.000	55.000	58.000	64.000	65.000
Hourly avg	44.960	44.520	43.760	43.320	42.640	42.600	43.000	43.800	44.880	47.625	49.600	51.240
Hourly max	63.000	63.000	63.000	62.000	62.000	61.000	61.000	61.000	61.000	64.000	68.000	67.000

Continued on next page

Table B-6. TEMPERATURE, degrees F
(continued)

Date, 1964		Time, beginning of measurement												Daily avg	Daily max
		1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300		
March	19				42.000	40.000	39.000	36.000	35.000	34.000	34.000	33.000	33.000	36.722	42.000
	20	44.000	48.000	49.000	49.000	49.000	48.000	46.000	45.000	44.000	44.000	43.000	42.000	38 708	49.000
	21	49.000	48.000	49.000	50.000	50.000	50.000	48.000	47.000	46.000	47.000	46.000	47.000	44.375	50.000
	22	36.000	35.000	35.000	34.000	34.000	34.000	34.000	34.000	34.000	33.000	33.000	33.000	38.083	46.000
	23	47.000	47.000	48.000	49.000	48.000	46.000	45.000	45.000	45.000	44.000	44.000	43.000	41.125	49.000
	24	50.000	52.000	59.000	60.000	63.000	63.000	61.000	59.000	57.000	56.000	54.000	54.000	50.042	63.000
	25	69.000	69.000	74.000	76.000	77.000	74.000	72.000	70.000	68.000	66.000	64.000	64.000	62.500	77.000
	26	70.000	74.000	78.000	60.000	57.000	59.000	54.000	49.000	46.000	45.000	44.000	42.000	59.417	78.000
	27	46.000	51.000	52.000	54.000	54.000	53.000	52.000	49.000	48.000	48.000	47.000	47.000	44.167	54.000
	28	55.000	56.000	58.000	58.000	56.000	53.000	50.000	48.000	46.000	47.000	47.000	47.000	48.333	58.000
	29	52.000	46.000	48.000	49.000	49.000	49.000	48.000	48.000	47.000	45.000	44.000	43.000	47.250	52.000
	30	34.000	40.000	40.000	41.000	40.000	38.000	37.000	35.000	34.000	33.000	31.000	30.000	36.300	41.000
	31	40.000	40.000	41.000	42.000	42.000	41.000	40.000	39.000	36.000	36.000	36.000	36.000	34.667	42.000
April	1	42.000	44.000	44.000	45.000	46.000	44.000	42.000	42.000	41.000	40.000	40.000	39.000	38.917	46.000
	2	46.000	43.000	42.000	43.000	44.000	44.000	44.000	44.000	44.000	45.000	45.000	46.000	41.167	46.000
	3	66.000	68.000	70.000	70.000	64.000	56.000	50.000	46.000	44.000	43.000	40.000	39.000	55.167	70.000
	4	48.000	50.000	50.000	51.000	50.000	49.000	48.000	47.000	46.000	44.000	43.000	43.000	41.917	51.000
	5	52.000	53.000	55.000	54.000	54.000	53.000	52.000	50.000	48.000	47.000	47.000	47.000	46.125	55.000
	6	42.000	43.000	44.000	44.000	44.000	45.000	46.000	47.000	47.000	47.000	47.000	48.000	45.130	48.000
	7	56.000	56.000	58.000	59.000	59.000	60.000	61.000	62.000	61.000	61.000	61.000	62.000	55.333	62.000
	8	60.000	54.000	52.000	54.000	53.000	51.000	49.000	48.000	47.000	46.000	45.000	43.000	55.375	62.000
	9	51.000	53.000	53.000	53.000	52.000	52.000	51.000	50.000	50.000	49.000	48.000	46.000	46.750	53.000
	10	65.000	66.000	66.000	66.000	64.000	62.000	56.000	57.000	57.000	54.000	54.000	53.000	55.292	66.000
	11	65.000	66.000	64.000	62.000	61.000	60.000	60.000	57.000	56.000	55.000	54.000	53.000	56.958	66.000
	12	65.000	65.000	69.000	69.000	69.000	67.000	65.000	63.000	62.000	61.000	61.000	61.000	59.250	69.000
	13	65.000												58.385	65.000
Hourly avg		52.600	52.792	54.083	53.360	52.760	51.600	49.880	48.640	47.520	46.800	46.040	45.640		
Hourly max		70.000	74.000	78.000	76.000	77.000	74.000	72.000	70.000	68.000	66.000	64.000	64.000		

Arithmetic mean, all observations - 47.6

Geometric mean, all observations - 46.6

Table B-7. HUMIDITY, percent

Date, 1964	Time, beginning of measurement											
	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100
March 19												
20	49.000	50.000	50.000	50.000	50.000	50.000	50.000	46.000	46.000	42.000	38.000	35.000
21	38.000	39.000	38.000	38.000	39.000	40.000	42.000	43.000	43.000	40.000	38.000	36.000
22	58.000	64.000	60.000	60.000	78.000	84.000	90.000	96.000	98.000	100.000	100.000	100.000
23	98.000	94.000	90.000	86.000	87.000	88.000	86.000	82.000	76.000	72.000	66.000	60.000
24	46.000	45.000	47.000	52.000	60.000	63.000	64.000	68.000	68.000	64.000	58.000	50.000
25	68.000	69.000	69.000	70.000	71.000	73.000	72.000	72.000	71.000	62.000	50.000	44.000
26	72.000	74.000	74.000	76.000	78.000	83.000	80.000	74.000	72.000	68.000	64.000	54.000
27	44.000	43.000	44.000	47.000	49.000	50.000	50.000	47.000	44.000	42.000	40.000	36.000
28	34.000	40.000	44.000	46.000	48.000	50.000	50.000	54.000	56.000	54.000	46.000	40.000
29	89.000	74.000	68.000	66.000	64.000	65.000	66.000	64.000	57.000	50.000	50.000	62.000
30	36.000	38.000	40.000	40.000	70.000	88.000	90.000	96.000	96.000	91.000	96.000	90.000
31	43.000	40.000	41.000	42.000	44.000	46.000	47.000	46.000	44.000	50.000	40.000	36.000
April 1	87.000	84.000	80.000	86.000	84.000	82.000	80.000	78.000	70.000	54.000	43.000	48.000
2	40.000	42.000	44.000	48.000	52.000	56.000	64.000	68.000	64.000	59.000	56.000	54.000
3	88.000	90.000	90.000	90.000	92.000	97.000	92.000	74.000	68.000	52.000	42.000	42.000
4	46.000	47.000	49.000	47.000	48.000	52.000	51.000	50.000	46.000	43.000	37.000	34.000
5	40.000	46.000	50.000	54.000	59.000	58.000	50.000	46.000	46.000	42.000	38.000	38.000
6	52.000	58.000	56.000	54.000	52.000	49.000	54.000	68.000	76.000	90.000	96.000	96.000
7	90.000	90.000	91.000	88.000	89.000	89.000	90.000	91.000	90.000	92.000	95.000	92.000
8	94.000	96.000	96.000	96.000	100.000	100.000	100.000	100.000	100.000	100.000	94.000	92.000
9	47.000	47.000	47.000	46.000	50.000	52.000	49.000	62.000	50.000	42.000	39.000	38.000
10	42.000	44.000	50.000	48.000	48.000	46.000	38.000	34.000	32.000	28.000	27.000	26.000
11	56.000	52.000	52.000	57.000	58.000	57.000	50.000	47.000	44.000	40.000	38.000	38.000
12	65.000	69.000	73.000	76.000	82.000	82.000	75.000	66.000	52.000	44.000	44.000	38.000
13	46.000	50.000	54.000	56.000	60.000	68.000	76.000					
14	96.000	97.000	98.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	98.000	96.000
15	100.000	100.000	100.000	98.000	98.000	96.000	80.000	56.000	48.000	46.000	56.000	52.000
16	29.000	29.000	30.000	30.000	32.000	32.000	36.000	32.000	26.000	24.000	22.000	20.000
17	47.000	49.000	47.000	51.000	53.000	52.000	51.000	46.000	43.000	36.000	29.000	24.000
18	34.000	37.000	40.000	42.000	42.000	42.000	41.000	36.000	34.000	30.000	26.000	24.000
19	47.000	54.000	57.000	62.000	64.000	69.000	66.000	62.000	66.000	67.000	62.000	56.000
20	100.000											
Hourly avg	60.031	59.710	60.290	61.355	64.548	66.419	65.484	63.467	60.867	57.467	54.267	51.700
Hourly max	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000

Continued on next page

GPO 817-288-4

Table B-7. HUMIDITY, percent
(continued)

Date, 1964		Time, beginning of measurement												Daily avg	Daily max
		1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300		
March	19				30.000	32.000	35.000	38.000	42.000	44.000	46.000	47.000	48.000	40.222	48.000
	20	34.000	32.000	32.000	31.000	32.000	32.000	33.000	35.000	36.000	37.000	38.000	38. 0	40.250	50.000
	21	36.000	38.000	38.000	39.000	38.000	43.000	42.000	38.000	38.000	40.000	42.000	46.000	39.667	46.000
	22	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	91.167	100.000
	23	58.000	56.000	56.000	55.000	55.000	58.000	62.000	64.000	32.000	47.000	45.000	45.000	67.417	98.000
	24	48.000	46.000	46.000	44.000	44.000	46.000	49.000	54.000	57.000	60.000	64.000	67.000	54.583	68.000
	25	40.000	36.000	32.000	30.000	34.000	37.000	40.000	48.000	56.000	64.000	68.000	70.000	56.083	73.000
	26	45.000	39.000	37.000	70.000	46.000	42.000	42.000	43.000	44.000	45.000	46.000	44.000	58.833	83.000
	27	34.000	29.000	27.000	26.000	24.000	25.000	26.000	28.000	30.000	32.000	32.000	32.000	36.708	50.000
	28	36.000	34.000	33.000	35.000	39.000	49.000	60.000	72.000	78.000	83.000	82.000	96.000	52.458	96.000
	29	40.000	30.000	24.000	23.000	23.000	24.000	24.000	27.000	30.000	32.000	34.000	34.000	46.667	89.000
	30		48.000	48.000	40.000	38.000	44.000	39.000	38.000	39.000	42.000	43.000	42.000	57.913	96.000
	31	36.000	34.000	35.000	31.000	30.000	33.000	34.000	40.000	46.000	48.000	80.000	86.000	43.833	86.000
April	1	48.000	32.000	29.000	28.000	28.000	29.000	30.000	32.000	33.000	35.000	36.000	37.000	53.042	87.000
	2	95.000	76.000	94.000	99.000	98.000	88.000	92.000	97.000	93.000	89.000	88.000	88.000	71.000	99.000
	3	46.000	55.000	50.000	49.000	48.000	51.000	54.000	66.000	64.000	62.000	46.000	48.000	64.833	97.000
	4	30.000	27.000	27.000	26.000	26.000	27.000	29.000	30.000	37.000	39.000	40.000	41.000	38.708	52.000
	5	34.000	32.000	28.000	26.000	28.000	30.000	33.000	40.000	50.000	54.000	56.000	50.000	42.833	59.000
	6	98.000	98.000	98.000	98.000	96.000	96.000	94.000	92.000	92.000	90.000	90.000	89.000	80.500	98.000
	7	91.000	100.000	100.000	100.000	100.000	100.000	97.000	94.000	91.000	98.000	92.000	91.000	93.375	100.000
	8	90.000	84.000	86.000	57.000	53.000	50.000	48.000	46.000	46.000	45.000	45.000	46.000	77.667	100.000
	9	37.000	36.000	34.000	34.000	32.000	32.000	32.000	31.000	34.000	35.000	35.000	36.000	40.708	62.000
	10	22.000	20.000	20.000	20.000	22.000	24.000	32.000	39.000	42.000	46.000	49.000	52.000	35.458	52.000
	11	37.000	34.000	35.000	35.000	36.000	38.000	42.000	46.000	52.000	54.000	57.000	59.000	46.417	59.000
	12	34.000	34.000	32.000	30.000	30.000	29.000	28.000	32.000	35.000	42.000	46.000	46.000	49.333	82.000
	13			61.000	61.000	58.000	63.000	67.000	70.000	75.000	77.000	78.000	84.000	64.941	84.000
	14	97.000	96.000	94.000	94.000	92.000	92.000	90.000	93.000	94.000	95.000	94.000	94.000	96.250	100.000
	15	36.000	30.000	27.000	24.000	22.000	30.000	30.000	36.000	36.000	32.000	30.000	30.000	53.875	100.000
	16	18.000	16.000	16.000	14.000	15.000	17.000	18.000	38.000	37.000	34.000	38.000	44.000	26.958	44.000
	17	21.000	19.000	18.000	18.000	18.000	19.000	20.000	23.000	24.000	27.000	29.000	32.000	33.167	53.000
	18	34.000	26.000	25.000	24.000	24.000	24.000	26.000	28.000	30.000	32.000	37.000	42.000	32.500	42.000
	19	58.000	59.000	60.000	80.000	99.000	100.000	96.000	96.000	97.000	97.000	98.000	100.000	73.833	100.000
	20													100.000	100.000
Hourly avg		48.034	46.533	46.516	45.969	45.625	47.094	48.344	51.813	52.875	54.969	56.406	58.031		
Hourly max		100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000		

Arithmetic mean, all observations - 55.3

Geometric mean, all observations - 50.3

Table B-8. WIND SPEED, miles/hr

Date, 1964		Time, beginning of measurement											
		0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100
March	7	4.500	4.000	3.500	3.000	3.500	3.500	4.500	4.500	5.000	6.000	5.500	5.500
	8	.000	2.000	3.000	.000	.000	2.000	4.500	5.000	8.000	8.500	9.000	1.000
	9	2.500	.000	.000	3.500	.000	2.000	2.500	2.500	2.000	2.000	3.500	5.000
	10	2.500	2.500	3.500	3.500	3.000	3.500	5.000	4.500	5.000	10.500	7.500	9.000
	11	7.500	6.500	7.000	6.500	5.000	5.000	5.500	6.500	6.000	5.500	4.500	5.000
	12												
	13	2.000	2.000	3.500	2.500	2.000	3.000	3.000	3.000	4.000	4.000	4.500	3.000
	14	4.000	4.000	3.500	3.000	4.000	4.000	4.500	4.500	6.000	6.000	6.000	4.500
	15	3.000	3.000	3.000	3.000	3.000	2.000	5.000	6.000	5.000	5.000	5.500	4.500
	16	4.500	3.500	4.000	3.000	4.000	2.000	2.500	3.500	3.000	5.500	6.000	6.000
	17	4.000	2.500	4.000	3.500	2.500	3.000	4.000	3.500	2.500	4.500	3.500	4.000
	18	7.000	6.500	6.500	8.000	8.500	8.500	7.000	5.000	7.500	8.500	8.000	8.000
	19	5.000	4.000	4.500	4.500	3.500	3.000	2.500	3.500	5.500	5.500	5.000	4.500
	20	3.000	3.000	3.000	3.000	3.500	3.500	3.500	4.000	3.500	3.500	4.000	3.500
	21	4.000	4.000	3.000	3.000	5.500	6.000	6.000	7.500	9.500	11.500	7.500	4.500
	22	4.500	5.000	5.000	6.000	5.000	4.000	3.500	4.000	4.500	4.500	4.500	4.500
	23	3.000	2.500	2.000	3.000	2.000	2.000	3.000	5.000	6.500	4.500	3.500	5.000
	24	.000	2.500	.000	2.000	.000	.000	2.500	5.000	5.000	5.000	4.500	4.500
	25	.000	.000	2.000	.000	.000	.000	.000	4.000	4.000	5.000	3.500	4.000
	26	3.000	3.500	2.000	2.000	3.000	4.000	5.500	5.500	6.500	6.000	7.000	8.000
	27	4.000	4.500	5.500	4.000	4.500	5.500	4.000	3.000	3.000	4.000	4.000	5.500
	28	2.000	2.500	2.500	2.500	4.000	4.500	5.500	4.500	3.500	3.500	4.500	7.500
	29	6.000	4.000	3.500	3.000	2.500	2.500	2.500	2.500	2.500	3.000	2.500	3.500
	30	3.500	3.500	5.000	5.000	4.500	3.000	4.000	4.000	3.500	4.000	4.000	5.000
	31	6.000	6.000	5.000	4.000	3.000	2.000	3.000	2.500	3.500	4.000	4.500	4.500
April	1	4.500	5.000	5.500	5.500	5.500	5.000	5.000	5.500	6.000	7.500	5.500	4.500
	2	2.500	2.500	3.000	4.500	4.000	4.500	5.000	6.000	6.500	8.000	7.000	9.000
	3	2.500	.000	3.500	4.000	4.000	3.500	2.500	4.000	4.500	5.000	5.500	5.000
	4	6.000	5.500	4.500	5.000	4.000	4.000	5.000	6.500	6.500	6.500	6.000	3.000
	5	2.000	.000	.000	.000	.000	3.500	5.000	4.500	4.000	4.500	3.500	4.000
	6	3.500	4.500	3.000	4.000	4.000	5.000	4.000	5.000	5.500	6.000	6.000	5.000
	7	2.500	2.500	2.500	2.000	.000	2.500	2.000	.000	.000	2.500	3.000	2.500
	8	2.000	2.500	.000	.000	.000	2.500	2.000	.000	2.500	3.000	2.500	2.000
	9	6.000	6.500	5.500	4.500	6.000	4.000	2.500	2.000	5.000	5.000	7.000	6.000
	10	2.000	3.500	2.500	.000	.000	2.500	3.500	.000	3.000	3.000	3.500	4.000
	11	2.000	.000	.000	2.000	.000	.000	2.000	2.000	3.000	5.000	5.000	3.500
	12	2.000	.000	2.500	2.000	2.000	2.500	3.000	3.000	4.500	3.000	4.000	5.000
	13	2.000	3.500	2.500	.000	2.000	3.000	3.000	3.500	5.000	4.500	3.500	3.000
	14	4.500	3.500	4.000	2.500	2.500	3.500	4.000	5.000	5.500	4.500	4.000	4.500
	15		.000	.000	.000	.000	.000	3.000	3.000	3.000	5.000	3.000	2.500
Hourly avg		3.408	3.103	3.167	3.013	2.833	3.192	3.718	3.936	4.603	5.205	4.910	4.705
Hourly max		7.500	6.500	7.000	8.000	8.500	8.500	7.000	7.500	9.500	11.500	9.000	9.000

Continued on next page

Table B-8. WIND SPEED, miles/hr
(continued)

Date, 1964	Time, beginning of measurement												Daily avg	Daily max
	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300		
March 7	6.500	5.500	5.500	4.500	4.500	4.000	2.500	2.000	3.000	2.000	.000	.000	3.875	6.500
8	9.000	7.500	3.500	6.000	5.500	6.500	6.500	5.500	6.000	5.000	5.000	4.500	4.729	9.000
9	5.500	6.000	6.000	6.000	6.500	6.000	5.000	4.500	4.000	4.500	4.500	4.000	3.667	6.500
10	6.000	7.000	6.500	9.000	9.000	6.000	7.000	5.500	6.000	6.500	5.500	9.000	5.958	10.500
11	4.500	4.000											5.643	7.500
12				5.000	4.500	4.000	3.000	3.500	4.500	4.000	2.500	2.500	3.722	5.000
13	3.500	5.000	6.500	6.000	4.500	4.500	4.500	4.000	4.000	4.000	4.000	4.000	3.792	6.500
14	5.500	4.000	4.500	4.000	3.500	4.000	3.500	3.000	5.000	3.500	4.500	3.000	4.250	6.000
15	5.000	4.500	5.000	3.000	2.500	3.500	4.000	3.500	5.000	4.000	4.000	5.000	4.042	6.000
16	5.500	7.000	6.000	4.500	3.500	2.000	2.500	2.500	3.000	3.500	4.500	2.500	3.938	7.000
17	4.500	5.000	4.000	4.500	5.000	5.000	4.500	6.500	7.500	5.500	5.500	8.000	4.458	8.000
18	7.000	7.000	8.500	8.000	7.000	7.500	5.000	5.000	5.500	5.500	5.000	4.000	6.833	8.500
19	5.500	4.500	5.500	5.000	4.500	4.500	3.000	3.500	3.000	3.500	3.000	3.000	4.146	5.500
20	5.000	4.000	4.000	3.500	3.000	3.000	3.500	3.500	3.000	3.000	2.000	4.000	3.438	5.000
21	4.500	3.500	3.000	4.000	3.500	2.500	4.000	3.500	4.000	4.000	4.000	4.500	4.875	11.500
22	5.000	5.000	5.500	5.500	5.000	3.500	3.500	3.000	3.000	3.000	4.000	3.000	4.333	6.000
23	4.500	4.500	4.000	4.000	3.500	.000	2.000	2.500	.000	.000	2.500	2.500	3.000	6.500
24	5.500	3.000	4.500	5.000	4.000	4.500	4.000	3.000	3.000	3.000	2.000	.000	3.021	5.500
25	4.500	4.500	5.000	6.000	7.000	5.500	4.000	5.500	4.500	3.500	3.500	3.000	3.292	7.000
26	7.000	7.500	9.000	8.500	8.500	7.500	11.000	8.500	5.500	5.500	4.500	5.000	6.000	11.000
27	5.000	5.500	4.500	5.500	4.500	5.500	5.500	4.500	5.000	4.000	3.000	2.500	4.438	5.500
28	6.500	6.000	6.500	7.000	8.000	7.000	7.500	9.000	9.000	8.500	6.500	5.500	5.583	9.000
29	4.500	4.000	5.500	5.000	5.500	6.500	7.500	8.000	5.500	5.500	4.000	3.500	4.292	8.000
30	5.500	5.000	6.500	8.000	8.000	9.000	7.000	7.500	5.500	6.500	6.500	6.000	5.417	9.000
31	5.000	4.000	4.000	4.500	4.500	5.000	4.500	4.500	5.000	3.500	3.500	4.500	4.188	6.000
April 1	5.000	4.500	5.000	4.000	4.000	3.500	3.000	2.500	2.000	3.000	2.500	4.000	4.500	7.500
2	6.500	6.500	7.000	7.000	7.000	6.000	5.000	4.500	3.000	2.500	2.500	2.000	5.083	9.000
3	4.500	5.500	5.000	4.000	5.000	8.000	8.500	7.500	7.000	7.500	8.000	6.000	5.021	8.500
4	4.500	3.500	3.500	3.500	2.500	3.000	.000	.000	.000	3.000	2.000	.000	3.667	6.500
5	3.000	3.500	4.500	4.000	4.000	3.500	2.000	4.000	3.000	3.000	3.500	4.000	3.042	5.000
6	4.500	5.000	6.000	4.500	6.000	4.500	3.500	.000	3.500	2.500	3.000	2.500	4.208	6.000
7	2.500	3.000	2.500	.000	.000	.000	.000	.000	2.000	3.500	2.000	.000	1.563	3.500
8	2.000	2.500	4.500	5.000	5.000	7.000	6.000	4.500	5.000	6.000	5.500	4.000	3.167	7.000
9	6.500	5.000	6.000	7.500	7.500	6.500	5.500	2.000	4.000	2.500	2.000	2.000	4.875	7.500
10	2.500	3.500	3.500	2.500	2.500	3.000	4.000	2.000	3.000	.000	2.000	3.000	2.458	4.000
11	4.500	4.500	4.000	2.000	5.000	4.500	2.000	.000	.000	.000	3.500	.000	2.271	5.000
12	4.500	5.000	4.000	4.500	4.500	5.000	6.500	5.000	4.500	2.000	.000	.000	3.292	6.500
13	2.000	4.000	4.000	4.500	7.000	6.500	5.500	4.500	3.500	2.500	2.000	4.500	3.583	7.000
14	3.500	3.000	3.000	3.000	3.500	.000	.000	2.500	.000	.000	.000	.000	2.771	5.500
15	2.500	2.500	2.000	3.000	8.000	6.000	3.000					2.000	2.553	8.000
Hourly avg	4.846	4.744	4.947	4.897	5.051	4.718	4.346	3.974	3.947	3.671	3.487	3.269		
Hourly max	9.000	7.500	9.000	9.000	9.000	9.000	11.000	9.000	9.000	8.500	8.000	9.000		

Arithmetic mean, all observations - 4.4

Geometric mean, all observations - 4.1

Table B-9. WIND DIRECTION, angular degrees

Date, 1964		Time, beginning of measurement											
		0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100
March	12												
	13	290.000	280.000	310.000	310.000	300.000	310.000	310.000	360.000	360.000	360.000	360.000	180.000
	14	180.000	180.000	190.000	170.000	160.000	160.000	170.000	180.000	170.000	190.000	190.000	190.000
	15	180.000	180.000	180.000	150.000	160.000	180.000	180.000	310.000	310.000	310.000	310.000	360.000
	16	190.000	200.000	200.000	190.000	200.000	180.000	220.000	180.000	180.000	180.000	330.000	320.000
	17	170.000	170.000	190.000	170.000	180.000	200.000	200.000	180.000	170.000	180.000	300.000	270.000
	18	320.000	310.000	330.000	300.000	290.000	290.000	290.000	290.000	290.000	300.000	320.000	340.000
	19	360.000	350.000	10.000	350.000	350.000	340.000	100.000	50.000	90.000	350.000	110.000	350.000
	20	350.000	350.000	50.000	40.000	30.000	50.000	60.000	50.000	60.000	80.000	80.000	190.000
	21	200.000	230.000	230.000	170.000	120.000	120.000	110.000	100.000	100.000	110.000	90.000	90.000
	22	50.000	40.000	60.000	60.000	70.000	60.000	70.000	350.000	20.000	50.000	350.000	40.000
	23	40.000	50.000	30.000	20.000	30.000	50.000	350.000	60.000	50.000	60.000	70.000	50.000
	24	.000	220.000	.000	30.000	.000	.000	160.000	220.000	220.000	220.000	200.000	160.000
	25	.000	.000	200.000	.000	.000	.000	.000	220.000	230.000	230.000	220.000	220.000
	26	190.000	190.000	140.000	110.000	150.000	220.000	220.000	220.000	230.000	230.000	230.000	230.000
	27	20.000	10.000	20.000	10.000	30.000	30.000	20.000	30.000	40.000	30.000	20.000	40.000
	28	100.000	140.000	140.000	130.000	130.000	130.000	120.000	130.000	140.000	130.000	140.000	150.000
	29	170.000	160.000	160.000	30.000	30.000	40.000	30.000	40.000	50.000	40.000	40.000	70.000
	30	30.000	80.000	90.000	100.000	130.000	130.000	130.000	90.000	100.000	90.000	110.000	90.000
	31	30.000	30.000	50.000	20.000	30.000	290.000	340.000	360.000	20.000	350.000	340.000	360.000
April	1	160.000	100.000	80.000	80.000	90.000	90.000	80.000	90.000	90.000	90.000	130.000	90.000
	2	240.000	260.000	270.000	240.000	250.000	240.000	260.000	270.000	250.000	250.000	270.000	250.000
	3	230.000	.000	270.000	240.000	250.000	230.000	230.000	260.000	230.000	240.000	240.000	250.000
	4	20.000	30.000	40.000	40.000	50.000	90.000	80.000	80.000	90.000	90.000	90.000	60.000
	5	270.000	.000	.000	.000	.000	110.000	120.000	140.000	140.000	150.000	220.000	210.000
	6	250.000	240.000	240.000	230.000	240.000	240.000	230.000	240.000	240.000	210.000	170.000	150.000
	7	260.000	270.000	260.000	260.000	.000	240.000	200.000	.000	.000	200.000	180.000	220.000
	8	230.000	280.000	.000	.000	.000	230.000	190.000	.000	220.000	240.000	250.000	250.000
	9	20.000	20.000	30.000	40.000	10.000	10.000	20.000	30.000	10.000	40.000	20.000	20.000
	10	100.000	10.000	120.000	.000	.000	270.000	270.000	.000	240.000	330.000	360.000	300.000
	11	190.000	.000	.000	120.000	.000	.000	100.000	90.000	90.000	110.000	120.000	140.000
	12	190.000	.000	200.000	200.000	180.000	110.000	100.000	120.000	130.000	130.000	220.000	190.000
	13	140.000	140.000	140.000	.000	120.000	110.000	130.000	130.000	140.000	140.000	190.000	230.000
	14	240.000	230.000	250.000	230.000	230.000	240.000	250.000	250.000	250.000	230.000	250.000	230.000
	15	180.000	.000	.000	.000	.000	.000	40.000	50.000	90.000	100.000	110.000	90.000

Continued on next page

GPO 817-289-3

Table B-9. WIND DIRECTION, angular degrees
(continued)

Date, 1964	Time, beginning of measurement											
	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300
March 12				300.000	320.000	320.000	360.000	320.000	310.000	300.000	340.000	360.000
13	150.000	120.000	140.000	130.000	140.000	140.000	150.000	180.000	190.000	190.000	190.000	200.000
14	180.000	180.000	180.000	190.000	160.000	180.000	190.000	190.000	180.000	180.000	180.000	200.000
15	320.000	310.000	350.000	360.000	180.000	270.000	230.000	210.000	200.000	190.000	190.000	200.000
16	310.000	310.000	320.000	290.000	310.000	180.000	200.000	180.000	170.000	190.000	190.000	180.000
17	230.000	200.000	200.000	180.000	300.000	310.000	310.000	320.000	360.000	360.000	340.000	310.000
18	320.000	360.000	360.000	360.000	360.000	360.000	360.000	360.000	360.000	360.000	360.000	360.000
19	320.000	90.000	90.000	360.000	340.000	350.000	60.000	80.000	340.000	90.000	90.000	100.000
20	190.000	180.000	190.000	180.000	200.000	200.000	200.000	190.000	190.000	220.000	120.000	100.000
21	50.000	50.000	20.000	40.000	40.000	50.000	50.000	40.000	40.000	50.000	60.000	60.000
22	50.000	20.000	40.000	10.000	20.000	350.000	350.000	40.000	50.000	10.000	350.000	40.000
23	60.000	60.000	70.000	50.000	60.000	.000	110.000	90.000	.000	.000	220.000	200.000
24	180.000	190.000	200.000	170.000	180.000	220.000	160.000	160.000	170.000	220.000	160.000	.000
25	230.000	250.000	230.000	230.000	220.000	230.000	220.000	220.000	220.000	220.000	200.000	200.000
26	220.000	240.000	340.000	350.000	340.000	10.000	20.000	30.000	40.000	50.000	30.000	40.000
27	30.000	10.000	20.000	330.000	30.000	20.000	30.000	40.000	30.000	30.000	50.000	90.000
28	170.000	230.000	220.000	200.000	220.000	230.000	230.000	230.000	230.000	230.000	200.000	200.000
29	90.000	100.000	40.000	50.000	40.000	40.000	30.000	40.000	30.000	30.000	40.000	30.000
30	90.000	80.000	90.000	30.000	40.000	40.000	30.000	30.000	30.000	20.000	30.000	40.000
31	310.000	300.000	280.000	260.000	260.000	270.000	250.000	250.000	260.000	200.000	200.000	190.000
April 1	90.000	40.000	40.000	20.000	350.000	360.000	360.000	340.000	30.000	250.000	250.000	260.000
2	260.000	250.000	260.000	250.000	250.000	250.000	230.000	230.000	230.000	180.000	180.000	200.000
3	270.000	330.000	280.000	290.000	320.000	20.000	20.000	30.000	40.000	30.000	30.000	20.000
4	90.000	70.000	80.000	90.000	90.000	80.000	.000	.000	.000	270.000	270.000	.000
5	240.000	180.000	230.000	200.000	160.000	140.000	230.000	240.000	240.000	230.000	250.000	240.000
6	160.000	140.000	140.000	140.000	150.000	140.000	150.000	.000	200.000	230.000	230.000	250.000
7	200.000	260.000	180.000	.000	.000	.000	.000	.000	240.000	250.000	250.000	.000
8	360.000	360.000	10.000	20.000	30.000	40.000	20.000	30.000	20.000	30.000	20.000	30.000
9	20.000	20.000	40.000	20.000	20.000	20.000	30.000	20.000	10.000	10.000	50.000	90.000
10	340.000	300.000	320.000	340.000	310.000	270.000	280.000	240.000	240.000	.000	240.000	260.000
11	220.000	190.000	220.000	220.000	240.000	230.000	200.000	.000	.000	.000	230.000	.000
12	210.000	190.000	210.000	190.000	230.000	230.000	250.000	250.000	250.000	220.000	.000	.000
13	220.000	230.000	240.000	230.000	250.000	250.000	250.000	250.000	230.000	200.000	210.000	250.000
14	190.000	180.000	140.000	190.000	170.000	.000	.000	190.000	.000	.000	.000	.000
15	50.000	40.000	30.000	40.000	30.000	20.000	30.000					

Arithmetic mean, all observations - 172

Geometric mean, all observations - 129

GPO 817-289-2